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SCIENTIFIC AMERICAN

CUTTING THE SIDE-LIGHTS OF A TRANSATLANTIC LINER

The Schilowsky Gyro-Automobile

The Fleet at Vera Cruz

Progress in Science and Invention

Vol. CX. No. 22
May 30, 1914

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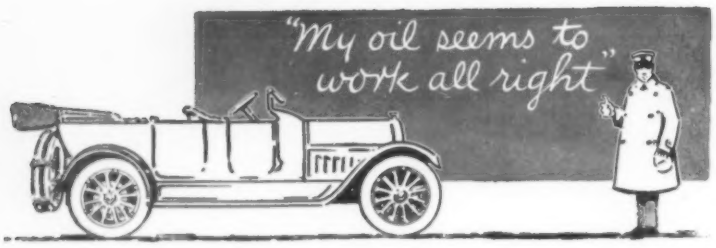

This hap-hazard expression is common among inexperienced motorists. It often brings costly penalties.

The motorist should never rest satisfied simply because he *sees* no trouble.

You cannot spare time to frequently examine your wrist-pins and bearings. Nor can you, after each run, inspect your cylinder walls and piston rings for signs of faulty lubrication.

Every good automobile motor is built to stand abuse—for a time.

No matter how inefficient your oil is, your motor for a while will "seem to work all right."

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And the poorly-lubricated motor which "seemed to work all right" too-commonly is headed for the repair shop.

Lubricating oil, to prevent power-waste and premature motor wear, *must* have two qualities.

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(2) Its *quality* must give full protection to the moving parts under the heat of service.

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For a number of years this Chart has been the standard scientific guide to correct lubrication.

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Correct Lubrication

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MODEL OF CARS	1910		1911		1912		1913		1914	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Abbott Detroit	A	Arc	A	Arc	A	Arc	A	Arc	Arc	Arc
Aleo	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	...	...
American	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Autocar (2 cyl.)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (4 cyl.)	A	E	A	Arc	A	Arc	...	...	...	...
Avery	A	E	A	E	A	A	A	A	A	A
" (Model C)	...	...	...	...	...	...	...	...	Arc	Arc
Buick (2 cyl.)	A	A	A	A	A	A	A	A	A	A
" (4 cyl.)	Arc	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (6 cyl.)	...	...	...	...	...	...	...	...	A	Arc
Cadillac	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cartercar	A	E	A	E	A	E	A	E	Arc	Arc
" Com'l.	A	E	A	Arc	A	Arc	A	Arc	...	...
Case	...	...	A	A	A	Arc	A	Arc	A	Arc
Chalmers	Arc	Arc	A	Arc	Arc	Arc	Arc	Arc	A	A
Chase (air)	B	B	B	B	B	B	B	B	B	B
" (water)	...	...	...	...	...	...	...	...	Arc	Arc
Cole	Arc	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Delaunay-Belleville	B	A	B	A	B	A	B	A	B	A
E. M. F.	Arc	Arc	Arc	Arc	Arc	Arc	...	...	...	...
Empire	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Fiat	A	A	B	A	A	A	B	A	B	A
Flanders	E	E	E	E	E	E	...	...	...	...
" (6 cyl.)	...	...	...	...	...	...	Arc	Arc	...	...
Ford	A	Arc	E	E	E	E	E	E	E	E
Franklin	B	A	Arc	A	A	A	A	Arc	A	A
" Com'l.	B	A	B	A	A	A	Arc	A	...	...
G. M. C. Truck	...	...	...	...	Arc	Arc	A	Arc	A	Arc
Havers	...	...	A	Arc	A	Arc	A	Arc	A	A
" (Model 6-60)	...	...	...	...	...	...	...	...	Arc	Arc
Haynes	A	E	A	Arc	A	Arc	A	Arc	A	Arc
Hudson	Arc	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Hupmobile (Model 20)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	...	...
" (Model 32)	...	...	...	...	...	...	A	Arc	A	Arc
I. H. C. (air)	...	...	...	...	...	...	B	A	B	A
" (water)	...	...	...	...	...	...	A	A	A	A
International	B	A	B	B	B	A	...	...	...	...
Interstate	A	E	A	Arc	A	Arc	Arc	...	...	...
Jackson (2 cyl.)	A	A	...	...	...	...	...	...	...	...
" (4 cyl.)	A	Arc	A	Arc	A	Arc	A	Arc	Arc	Arc
" (6 cyl.)	...	...	...	...	...	...	...	...	Arc	Arc
Jeffery	...	...	...	...	...	...	...	...	A	A
" Com'l.	...	...	...	...	Arc	Arc	Arc	Arc	Arc	Arc
Kelly	...	...	Arc	Arc	Arc	Arc	Arc	Arc	A	A
King	A	E	A	E	A	E	A	E	A	A
" Com'l.	...	...	...	...	...	...	...	...	Arc	Arc
Kissel Kar	A	E	A	Arc	A	Arc	A	Arc	Arc	Arc
" Com'l.	...	...	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" " (Model 48)	...	...	...	...	...	...	...	...	A	A
Kline Kar	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
Knox	A	A	A	B	A	B	A	B	B	A
Krit	A	A	A	A	A	A	A	A	A	A
Locomobile	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	E	E
Loeser	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	E	Arc
Mack	A	E	A	E	E	E	E	E	A	A
(Model S)	...	...	...	...	...	...	A	A	A	A
Marion	A	E	A	E	A	Arc	A	Arc	A	Arc
Marmon	A	E	A	Arc	A	Arc	A	Arc	A	Arc
Maxwell (2 cyl.)	E	E	E	E	D	E	...	...	...	...
" (4 cyl.)	E	E	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (6 cyl.)	...	...	...	...	...	...	Arc	Arc	Arc	Arc
Mercer	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Mitchell	Arc	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Moline	A	E	A	Arc	A	Arc	A	Arc	...	...
Moline Knight	...	...	...	...	...	...	...	...	A	A
Monel (4 cyl.)	A	E	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
" (6 cyl.)	...	...	...	...	...	...	...	...	Arc	Arc
National	A	A	A	A	A	A	A	A	A	A
Oakland	A	E	A	Arc	A	Arc	A	Arc	Arc	Arc
Oldsmobile	A	E	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Overland	A	E	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Packard	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	A
Paige Detroit	E	E	A	Arc	A	E	A	E	A	A
Pathfinder	...	...	...	...	...	...	A	Arc	Arc	Arc
Peerless	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Pierce Arrow	Arc	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
" " Com'l.	...	...	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Pope Hartford	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Rambler	A	A	A	Arc	Arc	Arc	Arc	Arc	...	...
Regal	A	E	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Renault	A	Arc	A	Arc	A	Arc	B	Arc	A	Arc
Reo	A	E	A	Arc	A	Arc	A	Arc	A	Arc
Saxon	...	...	...	...	...	...	...	...	E	E
S. G. V.	...	...	B	Arc	B	Arc	B	Arc	A	Arc
Selden	A	E	A	E	Arc	Arc	Arc	Arc	Arc	Arc
Simplex	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Speedwell	Arc	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" Mond	...	...	...	...	...	...	A	Arc	B	A
Stearns	Arc	Arc	A	Arc	A	Arc	...	...	...	...
" Knight	...	...	...	...	A	A	A	A	B	A
Stevens Duryea	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Stoddard-Dayton	Arc	Arc	A	A	A	A	A	A	...	...
" Knight	...	...	...	...	A	A	A	A	...	...
Studebaker	E	E	A	Arc	Arc	Arc	A	Arc	A	Arc
Stutz	...	...	...	...	Arc	Arc	Arc	Arc	A	A
Velie (4 cyl.)	A	E	A	Arc	A	Arc	A	Arc	A	Arc
" (6 cyl.)	...	...	...	...	...	...	...	...	Arc	Arc
Walter	A	E	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Waite	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Watson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc

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Scientific American Supplement No. 1644—*Soldering and Soldering Processes,* gives broad general information, and contains in particular a method for pulverizing solders and alloys of great use.

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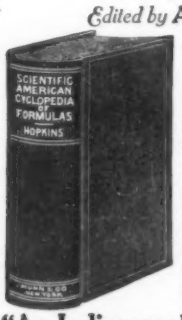

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THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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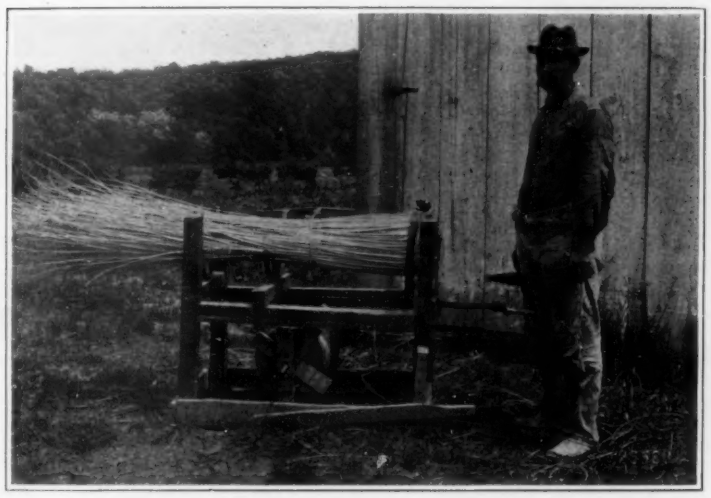
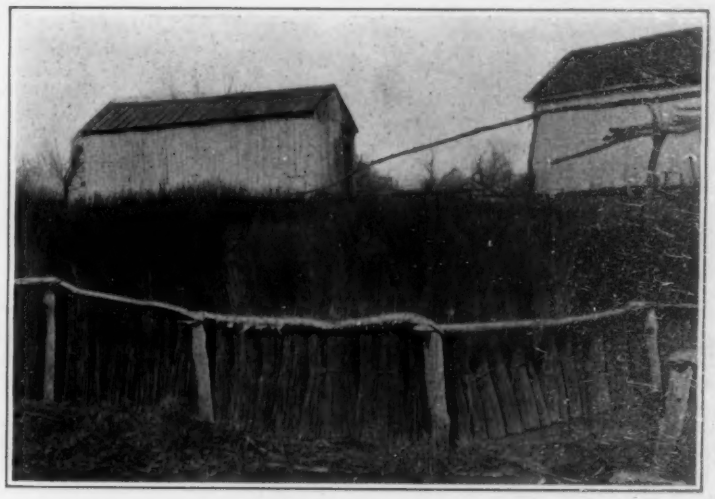
Grading into different height classes.

Drying and bleaching peeled willows.

Peeling the willow rods.



Tying the peeled rods into bundles for storage or shipment.



Bundles of American green willows in the pit ready to be peeled.

Basket Willow Culture in the United States

BASKET willows are of European origin and are now cultivated in all temperate climates. They thrive as far north as Norway and Sweden, and have been naturalized in portions of North and South America, Australia, and New Zealand. They are grown extensively in Great Britain, France, Belgium, Holland, Germany, Austria, and Russia. The chief producing districts of Europe are Germany, Holland, and France, where the conditions are particularly adapted to willows. These are highly esteemed by American basket makers, who use several thousand tons of imported rods annually. Willows grown in Belgium are also among the finest, but they are usually larger and suited principally for coarser basket ware.

There are many kinds of basket willows in cultivation, and much confusion exists in their classification. About ninety-five different strains considered valuable commercially are known in Europe. The varieties now most in use in this country are purple willow (*Salix purpurea*), American green willow (*Salix amygdalina*), Lemley willow (*Salix pruinosa*), and Patent Lemley willow (*Salix pruinosa acutifolia*). The purple willow is by far the best variety for American conditions, and it has been grown successfully from Maine to Minnesota and southward to Kentucky and Tennessee. It readily adapts itself to a great variety of climatic and soil conditions and produces tough, pliable rods much sought by basket makers. Climate and soil have much to do with the successful cultivation of willows. In regions with a mild and humid atmosphere the best length of rods and, therefore, the greatest yield per acre is obtained. Loose, rich, and moist sandy loam soil is most congenial to their growth. Willows may be grown in any part of the United States where these soil conditions obtain, and when rationally treated no other crop gives more profit. The difference in quality of willow rods does not arise so much from the difference in kind as it does from the result of soil and general treatment. The same variety will produce good, long flexible rods in one part of the plantation, while in another they may be short, brittle, and branching.

Basket willow cultivation has been a declining industry until recently. Serious injury was done to it, both in this country and in Europe, when rattan and other substitutes began to be introduced. The prevailing low prices of splint baskets and sea-grass furniture are also factors in its decline. The demand for willows is again increasing, and a brief discussion of their culture followed in the willow-growing districts should, therefore, be of interest.

American green willow growing in Maryland.

Four varieties are grown in northern New York, but the principal kind is the purple. The soil chosen is a deep rich humus with a moderate amount of sand, which retains the required amount of soil moisture. The climatic conditions are likewise favorable to willows. Reports covering ten years show an average annual rainfall of 35 inches. This amount of moisture is an essential condition for the attainment of a good crop. The willow zone of northern New York is thus largely determined by the peculiar character of the soil.

The ground is prepared so as to clean it of weeds, and place it in a condition to facilitate the wide penetration of the roots of the willow, and also to conserve moisture during hot weather. The success of this work, like in all other undertakings, depends upon the management, which must be in the hands of men who are able personally to direct the work and who have at the same time a material interest in the welfare of the plantation. In New York most willow plantations are owned by farmers who cultivate and harvest their own crops. No systematic method of manuring has as yet been undertaken. A few growers use well-rotted barnyard manure and spread it between the rows and work it in the upper stratum.

Cuttings are planted early in March, and the operation is intrusted only to those who have knowledge of the work. The length of the cuttings should vary

(Concluded on page 453.)

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Latin-American Attitude to the United States

FOR the reason that we believe it represents the attitude of the intelligent Latin-Americans toward the foreign policy of the United States, at least so far as it affects the Western Hemisphere, we publish with much pleasure, and direct special attention to the letter from a correspondent in Cuba, which will be found on our correspondence page. The writer has appreciated at their full value the motives and convictions which prompted our publication of the series of articles entitled "The Problem of Our Navy;" and we believe that if toll could be taken of the opinion of the more intelligent citizens of the Latin-American countries, it would be found that there is a general appreciation of the fact that the best guarantee of the inviolability of the New World against armed aggression by the nations of the Old World, is the possession by the United States of a fleet of such power, and in a condition of such thorough preparedness, that none of the navies of the Old World could measure arms with it, in the waters of the Western Hemisphere, without running the risk of a defeat.

It is discouraging, in view of what we have done in Cuba, to realize that there is a certain amount of distrust of the United States existing among the great mass of the people of the Latin-American republics. As an instance of disinterested and highly idealistic attitude toward a weaker state, the United States may point to the history of our relations with Cuba with a pride which is altogether justifiable. We entered that distracted island for the express purpose of regulating its many disorders and with the definite statement that we had no wish to permanently occupy territory, and with a pledge, further, to withdraw our forces as soon as a stable government had been established. That pledge we have fulfilled to the letter; and Cuba stands to-day as an undeniable proof of the fact, first, that the attitude of the Government of this country to the rest of Latin-America is altruistic, in so far as we earnestly desire to see it prosper under strong, independent, and capable governments; second, that our attitude is egotistic, only so far as our Government realizes that the abolition of revolutions, the harmonizing of contending factions and the setting up of orderly governments, conduces to the prosperity of the United States and promotes the advancement and solidarity of the Western Hemisphere as a whole.

Air and Water Resistance of the Racing Yacht

THE resistances which have to be overcome in getting speed out of a racing yacht, especially if she is going to windward, may be broadly divided into those which are encountered respectively above and below the water-line. Although by far the greater part of the sail power is expended in driving the hull through the water, not a little of it (much more than would be generally supposed) is absorbed in forcing the towering superstructure of sail, mast, and wire rigging against the wind.

Although it may seem paradoxical to say that the wind power which drives the yacht forward tends also to hold her back, it is a fact that when a yacht is close-hauled or heading into the wind, the head resistance of the wind and its skin-friction along the sails, total up a very considerable amount. When a yacht is making 19 knots against a 25-knot wind, the resultant wind velocity through her rigging will be about 30 knots. This is well understood by the yacht designer; and, during the races of the past fifteen years, great attention has been paid to this element of the problem. It so happens that the constant endeavor to save weight aloft, by the substitution of hollow steel masts and steel wire for wooden masts and manila rope, has also tended to reduce dimensions, and so cut down head-wind resistance. When we bear in mind that the standing and running gear of a modern racing yacht will total up from 2,500 to 3,000, or even 3,500 linear feet, and that the mast of an "America" cup yacht will present a total square surface of nearly 200 square feet to the wind, it will be understood that, in races that are sometimes won by seconds, the question of wind resistance is an important one. In addition to head resistance there is the skin-friction of the wind along the sails, and it is somewhat in the effort to lessen this that in a modern yacht the cloths of the sails are run approximately horizontally, so that the flow of the wind may be more along the seams than across them.

The resistance of the hull may be classified under wave-making; eddy-making; suction or drag; and skin resistance. Wave-making is the most important element of resistance at the higher speeds, and increases very rapidly with the increase of speed; in light airs and at the lower speeds skin resistance, or the friction of the water against the wetted surface of the hull, is the more important. Wave-making is due to the rapid displacement of the water as the yacht progresses, and its magnitude for a given speed is, of course, greatly affected by the underwater model of the yacht. At the higher speeds a mass of water is continually being lifted in the form of waves to a certain height above the general water level. This means that work is being done upon the water, and that a proportional amount of the driving energy of the wind is being thus absorbed. If there is anything wrong with the model of the yacht, especially in her run and quarters, and the stern wave does not rise snugly along the quarters, but follows several feet astern of the yacht, there will be heavy drag, and she will tend to pull a certain amount of water after her, and this will mean a further consumption of energy.

The designing of a yacht, such as those which contend for the "America's" cup, is complicated by the fact that the weather conditions throughout a season's yachting will vary from gentle airs to very strong winds; and the most successful yacht, other things being equal, will be the one that maintains the best mean speed under the average of all weather conditions.

Past experience, extending over more than a quarter of a century, has proved that on the race course off Sandy Hook the prevailing winds are light; and hence, of two well-designed and equally well-sailed yachts, the one which presents the largest amount of sail area per square foot of wetted surface should prove to be the winner of a series of races—this for the reason that, at moderate speeds, the skin friction is the most important element of resistance. Our American yacht designers seem to have recognized this fact, or, at least, they have paid more attention to it than the British challengers; for it is a fact that, with sheets started, in light airs, our yachts have always won out by a handsome margin. In the one case in which the challenger has pulled away from the home boat when running before the wind ("Shamrock II" versus "Columbia"), the "Shamrock" spread about 1,000 square feet more of canvas than "Columbia" above a hull which probably had somewhat less wetted surface.

There is one other element of resistance, the importance of which can scarcely be over-estimated, and that is the drag due to the rudder. Theoretically, in a properly designed yacht, in which the center of wind pressure is in the correct position with regard to the center of the vertical underwater plane of the hull, the rudder, even when the yacht is sailing close-hauled, should be practically amidships. The least putting over of the helm produces a corresponding drag upon the hull, with a resulting loss of speed. A well-balanced yacht should carry a slight weather helm in going to windward; but an experienced captain will pay such close attention to the trim of his sails that he will practically eliminate this; and it is our belief that the remarkable results obtained by the late Capt. Barr in working to windward in light airs, was largely due to his appreciation of this fact.

The Protection of Our Migratory Birds

OUR farmers suffer a loss of $800,000,000 annually from the ravages of the boll-weevil, the gypsy moth, the Colorado beetle, the rush fly, the codling moth, the white scale, and many other pernicious insects. Congress has from time to time authorized the expenditure of millions for the extermination of these pests, and yet Congress hesitates adequately to protect birds which are known to be the natural enemies of destructive insects.

Most insects like the green leaf louse, or aphis, so ruinous to the hop industry, and many other of our most valuable fruits and vegetables, reproduce their kind at the rate of ten sextillion to the pair in one season. The natural increase of one pair of gypsy moths would defoliage the United States in eight years. Locusts, army worms, and chinch bugs, unless checked in procreation, soon become countless hordes, devastating wide areas of the earth's surface. Dr. Lintner of the New Jersey Board of Agriculture reports that one hundred and seventy-six species of insects attack the apple tree. Approximately the same number attack peach, plum, and cherry trees. Dr. Packard finds four hundred species feeding upon the oak; and three hundred attacking the conifera. The number feeding upon cereals, grains, and garden crops is huge. Dr. Marlatt estimates that the loss to the wheat-growing States in 1904, occasioned by the Hessian fly, was about $50,000,000, and Dr. Shinar places the damage done to crops in the Mississippi Valley by the chinch bug in one year as high as $100,000,000. The Rocky Mountain locust, during the years of its greatest activity, caused a loss to the States of the Northwest of more than $150,000,000. Cut worms, Dr. Lintner assures us, mean an annual loss to farmers of $100,000,000. Clearly, it is not a gross exaggeration to place the damage to our crops and fruit trees at $800,000,000 annually.

Under most State laws, local game is adequately protected; for the average open season does not exceed six weeks, and often no shooting or fishing is allowed for several years. With migratory birds the open season often exceeds eight or nine months. This means eventual extermination under State regulations, and with the destruction of wild fowl and insectivorous birds the entire nation suffers. Each woodpecker is worth $20 to this country, according to the Department of Agriculture.

Certain varieties of snipe are now extinct, and the remainder, but a straggling remnant, is still being shot ten months in the year. In 1857, an Ohio's Senate Committee's report stated: "The passenger pigeon needs no protection." Fifty-five years after this was written the bird which existed in countless millions became totally extinct.

At one season of the year practically all the ducks of the United States are crowded in the marshes and swamps of Louisiana and Florida; for there food is abundant. Hence, it is difficult to convince the people of the South that there is any scarcity of wild water fowl. The official record of wild fowl killed in Louisiana during the season of 1910 is as follows: Wild ducks, sea and river, 3,176,000; coots, 280,740; geese and brant, 202,210; snipe and plover, 606,635. At this rate our migratory birds will be extinct in a few decades.

The early idea predominated that any restriction imposed upon the right to make assaults upon nature's storehouse was a restriction and an abridgment of human liberty and, therefore, hostile to the principles of free government. More recently the American people have become thoroughly awakened to the imperative necessity of conserving our natural resources, and among those resources wild birds are not the least important.

The Weeks-Maclean law is intended to protect our migratory birds, but Congress has manifested no great desire to make it effective by appropriating a suitable sum for its enforcement. The sum of $100,000 which was asked will not provide even a single Federal warden for every State. It takes about $2,500 to cover the annual pay and traveling expenses of such an official. On the other hand, to prevent the adulteration of Paris green and other insecticides Congress appropriates $95,000; to establish an agricultural experiment station on the island of Guam, $15,000; to fight gypsy and brown-tail moths, $297,540; to fight cotton boll-weevil and for farmers' co-operative demonstrations, $628,240; improvement of tobacco, $28,000; investigation of plant diseases, including diseases of ginseng, etc., $37,000. The protection of migratory birds is no less important than the erection of a station at Guam, or the prevention of adulteration of insecticides.

The Canadian government has prohibited the shooting of wild fowl in all its great Provinces, and it expects this Government to do likewise. Neither country is concerned about the State or provincial laws, regulating the shooting of local birds in the home district of their neighbor, but much interested in proper laws for the preservation of game in which each has an interest and a duty. Fully 75 per cent of the migratory game birds are raised in Canada; yet American game butchers, immediately beyond the Canadian border line and along the passage of migratory flight, claim the legal right of exterminating birds as they see fit.

Thanks to the activities of the American Game Protective Association, there is every prospect that a treaty will be enacted between the United States and Great Britain which will stop the reckless slaughter of migratory birds that has gone unchecked for generations on the North American continent. When that treaty is ratified migratory birds will be protected during nearly the complete line of their flight.

Engineering

Launching of Cup-Defender "Defiance."—"Defiance," designed by Owen, built at the Bath Iron Works, and launched at the yards of this company, is now under sail. The yacht has been built by what is known as the tri-city syndicate, of which Mr. George S. Pynchon is chairman. She is of composite construction, with steel frames covered by two thicknesses of wood, one of fir, the other of mahogany. A full description of the yacht appeared in our issues of May 2nd and May 9th.

The Destroyer "MacDougal" Makes 32.07 Knots.—While running her standardization trials the new destroyer "MacDougal," built at the Bath Iron Works, made a maximum speed of 32.07 knots for one mile and averaged for five full-speed runs 31.52 knots. The "MacDougal" measures 300 feet on the water-line, 30½ feet beam, 9 feet 5 inches draft, and displacement is 1,025 tons. She is armed with four 4-inch 50-caliber guns and eight 18-inch torpedo tubes. She is an oil burner, carrying a supply of 309 tons of oil.

Behavior of Concrete in Sea Water.—In 1909 several reinforced concrete posts made from different materials of different proportions and in varying degrees of thickness, were submerged in sea water at Boston, where they have been exposed to tide variations and ice conditions. A recent booklet of the Aberthaw Construction Company of that city states that thus far it has been determined that a dense concrete will better resist the combined physical and chemical action of sea water, flotsam and ice than will a porous concrete.

Alaskan Engineering Commission.—President Wilson has appointed the members of the commission which is to have charge of the location and construction of Government railways to be built in Alaska. The commission consists of Messrs. Edes, Mears and Riggs, who are now on their way to Seward, Alaska, which will form the headquarters for the Summer. The first work to be done will be the survey of a route from Portage Bay to the vicinity of Fairbanks. Applicants for work on the engineering force should address the Alaskan Engineering Commission, Department of the Interior, Washington, D. C.

An Ancient Horse-drawn Train Service.—According to the *Engineer*, it was only last month that there was brought to a close a passenger train service maintained by horse traction, which has been in continual operation since the year 1856. The stretch of line affected is a portion of the North British Railway, lying between Drumburgh Junction, a few miles west of Carlisle, and Port Carlisle, a seaport on the Solway Firth. The line was operated by locomotives from 1854 to 1856, and in August of the latter year horses were substituted. They have been in continuous use up to the present year, when they were superseded by steam locomotives.

A 113-mile Electrification of a Steam Railroad.—The Chicago, Milwaukee & St. Paul Railroad is about to electrify a portion of a 440-mile stretch of railroad across the Belt, Rocky and Route Mountain ranges. The first section will be 113 miles in length. Direct-current, 2,400-volt traction will be adopted, and regenerative electric braking will be used instead of the customary air braking. The section will be operated with twelve 200-ton freight locomotives, four 200-ton through passenger locomotives and two 100-ton local passenger locomotives. The estimated cost of the installation is $1,500,000, exclusive, of course, of the cost of the locomotives.

The Stress of Sea Waves.—In his recent lecture before the Royal Institution at London, on modern ships, Sir John Lyle drew attention to the fact that, when the waves are one half the length of the ship and one twentieth of the length in height, the stress upon the ship itself was very little increased above that in smooth water. But when the waves are of the same length as the ship, or one and one half times its length, the stresses are considerably higher than when the ship is in smooth water. Hence, in view of the fact that waves are seldom over 500 feet long, the maximum bending moments which come upon a ship 900 feet long, such as the "Aquitania," are much less than those which come upon one 500 feet in length.

Canal-Boat Elevator.—A somewhat original construction in the shape of a canal-boat elevator is in use on one of the canals in the north of France which connects the ports of Dunkerque and Calais with the industrial and mining region. It consists of two metallic basins lying side by side and about 130 feet in length. Each tank is carried on a vertical hydraulic piston, one tank rising while the second one falls. Connection with the ends of the canal is made by a system of gates and also a rubber tube joint between tank and canal end, the rubber tube being filled out by compressed air so as to make a tight joint, whereupon the gates are opened. One tank being at the top and the second at the bottom, the joint is made at the top tank, the gates withdrawn, and water enters the top tank to the level of 8 feet. After the canal-boat is run into the tank the gates are closed.

Science

The Preparation of Eye-Preserving Glass for Spectacles.—Sir William Crookes recently read a paper before the Royal Society of London, in which he points out how the injurious ultra-violet rays of the sun may be cut off so as to protect the eyes in tropical countries. Experiments made by Sir William to protect the eyes of blowers of glass vessels resulted in the discovery of a composition of glass, sage green in color, that cuts off 98 per cent of the heat rays. This glass is composed of ferrous oxalate, soda flux, red tartar and powdered wood charcoal. Sir William's experiments showed that it was possible to make no less than six different glasses to shield the eyes from heat rays. Sir William gives complete details, and explains how the glasses are made in his paper.

The Roosevelt South American Trophies.—Most of the 2,500 specimens of big game, mammals and birds bagged by George K. Cherrie and Leo E. Miller, members of the Roosevelt-Rondon expedition, have arrived at the American Museum of Natural History. Many of the specimens in the collection are new to the museum, and possibly some are new to science. Mr. Miller, mammalogist of the party, covered some 3,000 miles in exploration and collecting trophies for the museum. He first went up the Paraguay in steamers and launches as far as the river was navigable, and then he proceeded on a 500-mile jaunt over land, traveling on muleback. For forty days he journeyed through a country with little vegetation and through a desert-like region.

Piano Touch.—It is usually considered that no mechanical piano player, however excellently constructed, can reproduce the exact efforts produced by human touch. From the analysis of Prof. Bryan, it would appear that this belief must yield to scientific analysis. He analyzes the precise meaning to be attached to "touch," and shows that it may be perfectly reproduced on a pneumatic piano by means of an auxiliary lever which operates directly on the bellows, and is regulated by a sliding weight gliding on the lever itself, or by the direct pressure of the hand. The analysis is very thorough and scientific, and it is perhaps a mere confession of human weakness to say that it does not entirely convince one who has heard Sachmann play Chopin.

The Brazilian Expedition of the University of Pennsylvania, under Dr. W. C. Farabee, has completed a year of arduous and remarkably fruitful explorations, the first of which were made along some of the northern tributaries of the Amazon beyond the limits of previous exploration, while the more recent work has been done in the highlands lying on the frontier between Brazil and the Guianas. Last November Dr. Farabee started from Dadanawa with 40 native carriers on an easterly march through completely unknown territory, in the course of which he discovered several new tribes, none of which had ever before seen white men, guns, clothing or matches. The natives of this region are among the most primitive savages in the world. The explorers reached Georgetown, British Guiana, April 19th.

The Sedov Relief Expedition which the Russian government is sending north this Summer now gives promise of being a more elaborate undertaking than was originally contemplated, and, whether it succeeds or not in finding Capt. Sedov and his companions, will probably achieve interesting geographical results. It will consist of the steamers "Hertha" and "Andromeda" and the motor-vessel "Tatiana." These boats will first visit the Panceratiev Islands, off the coast of Nova Zembla, the last known location of Sedov's party, and the place from which he expected to start last Summer for Franz Josef Land. If he is not still there, the "Hertha" will take the stores from the "Tatiana," together with dogs and sledges, and endeavor to reach Franz Josef Land, while the "Andromeda" will cruise north along the coast of Nova Zembla, and the "Tatiana" will return to Archangel. The "Hertha" may find it necessary to Winter in Franz Josef Land. Her equipment includes a hydroaeroplane.

The Stackhouse Antarctic Expedition will not be able to leave England in August, as was originally intended, and may be postponed until next year. The earlier announcements regarding this expedition indicated that its principal object was to be the exploration of King Edward VII. Land, but the plans appear to have been gradually modified with the progress of time. The latest announcement is that the expedition will first land a party of twelve men on Graham Land to carry on scientific work there, while the ship will proceed along the coast, and probably winter somewhere near Prince Regent Luitpold Land, where the Austrian expedition under König, and the British expedition under Shackleton, also expect to have their Winter quarters. In the Antarctic Spring of 1915, it is proposed to have the ship pick up the Graham Land party, and, after coaling at Deception Island, to survey the west coast of Graham Land, and pass the next Winter in the neighborhood of Charcot Land. The following season, an attempt will be made to trace the supposed coast-line all the way west to King Edward VII. Land.

Automobile

An Improved Carbureter.—Patent No. 1,092,953 to Augustus M. Sanborn of Stanford University, Cal., is for a carbureter in which the hydrocarbon is mechanically projected into the air current in the form of a circumferential spray.

Puncturing Tires to Stop Automobiles.—Automobiles do not always stop when ordered by constables or other law officers, and Constant Le Duc of Chatsworth, N. J., in patent No. 1,094,226 provides an implement which can be extended so as to bring it into the path of a vehicle. The spurs on the implement will puncture the pneumatic tires, thus bringing the vehicle to a stop.

Motor 'Bus Service in Saxony.—The Saxony government has appropriated the sum of $450,000 for the purpose of extending the working length of its State motor omnibus lines from 200 to 700 kilometers. Nineteen new lines will be established and two private lines taken over; an existing State passenger line also is to be taken over and extended for the transportation of merchandise.

Another American Knight Patent Issued.—After having been in the mills of the United States Patent Office for eight years—the application was made in 1906—patent No. 1,090,991 has but recently been issued to Charles Y. Knight, the inventor of the sleeve valve engine that bears his name. The patent supplements another issued in 1910 and covering a single sleeve valve engine. The new patent, which has 43 claims, covers the well-known Knight sleeve valve mechanism and also deals with an improved lubrication system.

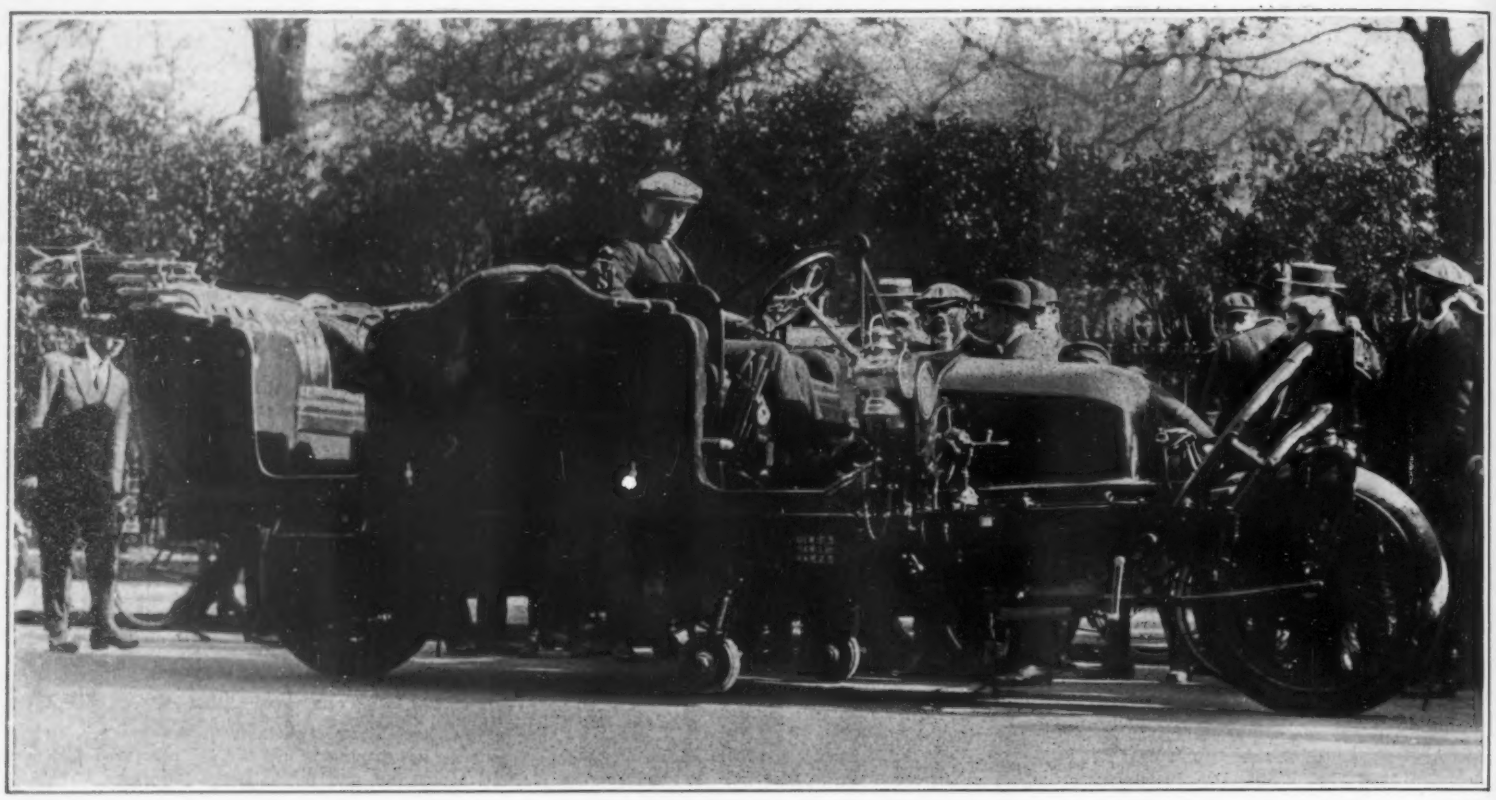
Fenders Leave Something to be Desired.—After having had ample time in which to test out the efficiency of the fenders required by law on commercial vehicles in the city of Detroit, owners of vehicles and drivers are practically unanimous that they are not of much use in preventing accidents—for which they were intended—and that they hamper the movements of the vehicles. It is pointed out in particular that the use of fenders considerably increases the over-all length of the vehicle and so shortens its turning radius; furthermore, fenders are easily damaged.

Use of Compressed Air in Steel Hardening.—Recently there has been adopted in a foreign motor car factory a new method of hardening steel with jets of compressed air. The usual method of hardening steel by immersion in oil or water or alkaline baths, it is said, results in the formation of a line of considerable tension between the hardened and unhardened parts. By the use of compressed air, however, the zones of cooling may be carefully graduated and much better results obtained. By adapting the shape of the nozzle to the work, a wide range of results is possible.

Horses are Really Going.—The statement "the horse must go" has been reiterated so often that it no longer attracts attention. But the horse really is going—and going fast. Of thirty-one principal American cities, sixteen show a noteworthy decrease in the number of licensed horse-drawn vehicles in relation to population. The percentages of decrease in seven of these cities, as collected by an organization of horse interests, are suggestive. They are as follows: Indianapolis, 14.5; Columbus, Ohio, 5.9; San Francisco, 4.8; St. Louis, 2.4; Omaha, 2.1; New York, 0.8; Chicago, 0.5. In the other nine cities the average decrease has been 2 per cent, whereas the average increase in population has been 7.8 per cent per year.

Foot-operated Gear Shifter.—The electric gear shifter now has become fairly common and there are several devices of the kind operated by compressed air. Now, however, there has appeared another which is operated by the movement of the clutch pedal. It has just been placed upon the market. The apparatus consists of a selector which is placed adjacent to the steering wheel, the shifting mechanism itself weighing about 10 pounds and attaching directly to the gear box. In operation, the driver selects the gear he desires, and the subsequent depression of the clutch pedal shifts the gears automatically. If a gear selected is not wanted, and it is deemed expedient to use another, the selection of the other disengages the first.

Novel Type of Cyclecar Drive.—There has been placed upon the market lately a cyclecar which has an unusually novel method of power transmission. The vehicle is propelled through one front wheel and not, as ordinarily is the case, through two rear wheels. To obtain the necessary changes in gear ratio there is a friction transmission mechanism in which the driving plate is the front of the flywheel, which, in this case, is ahead of instead of behind the engine. The driven member of the transmission is slidably mounted, so that it can be shifted across the face of the driving disk, and is connected to the front wheel drive through the intermediary of a universal joint and internal spur gearing within the wheel hub. It is claimed that ample traction is obtained and that skidding is avoided for the reason that the propelling power is a pull rather than a push.



The Schilowsky monotrack automobile.

The Principle of the Bicycle Applied to the Motor Car

A Two-wheeled Automobile Stabilized by Means of a Gyroscope

THE gyroscope and its applications need no introduction to our readers. Its use for stabilizing ships, for steadying torpedoes and for ships' compasses, are all well known. Efforts have also been made to adapt the gyroscope for the automatic stabilizing of aeroplanes. Its use by Brennan to maintain the equilibrium of a monorail car is fresh in our memories. The latest development is a two-wheeled automobile, designed by the Russian engineer, P. Schilowski, which is kept balanced by a gyroscope mounted on the machine. The car is shown in the accompanying halftone illustration. It is a full-size vehicle, capable of carrying from four to six people on an ordinary road track.

Its inventor, in a paper recently presented before the Royal Institute of London, summed up in the following words some of his conclusions relating to the principles to be observed in the design of such cars.

The most desirable method of suspension of a gyroscope for stabilizing a monorail or a monotrack car is suspension below the center of gravity of the wheel, or neutral suspension with a top load, as it permits of the vehicle taking smooth curves in each direction. Increasing the instability of the gyroscope, by adding to the top load, allows the vehicle to take sharper curves.

A special device for hurrying up the precession is unavoidable in any gyroscopic vehicle which must take sharp curves in the same direction as the rotation of the flywheel.

However the gyroscope may be mounted, and in whatever direction the vehicle must run, in order to maintain the equilibrium of unstable bodies for any length of time, it is absolutely necessary to apply a precessional system for restoring the plane of the wheel whenever precession takes place, and it is not sufficient to increase the stability of the gyroscope by only increasing the speed. The only instance in which a device for hurrying up the precession is not required to bring back the gyroscope to its normal position, after it has been disturbed, is that of the common peg top spinning on a rough surface. In this case, the gyroscope must be entirely free of any support or mechanism, and the friction between the rounded axle and the surface on which the top is spinning automatically hurries up the precession and the top rises again.

The car, when running at a high speed, can with safety only take a curve increasing gradually in steepness. Beyond a certain point dangerous oscillatory disturbances would be produced. Here we come into conflict with statements which are often found in technical books, that gyroscopic vehicles can, by their very nature, take the sharpest of curves. As a matter of fact, if a sharp bend has to be made, the curve must be gradually increased somewhat after the manner of a parabola or ellipse.

The details of the gyroscope mechanism are illustrated in the accompanying diagrams. For these and the data relating to them we are indebted to *The Engineer*. They relate strictly to a monorail car, built by Mr. Schilowsky, but the principle is exactly the same as that employed in the bicycle-automobile.

Starting with Fig. 1, we have here a cross-section of the car, *A* being the central girder and *B B* the side frames. On the girder *A* and directly over the center line of the car wheels *C* a pillar *D* is erected. At its top this pillar carries rigidly two parallel arms *E E*. Two pendulums *F F* are hung from these arms, the bobs *G* of which consist of cylinders having their axes parallel with the longitudinal axis of the car. To the cross arms *E* two cords *H* are attached. These cords, passing vertically downward, are accommodated in shallow grooves running round the circumference of the bobs, and are thereafter taken round pulleys *J* journaled on the frames *B*. From these pulleys the cords pass vertically upward. When the car is on an "even keel" the cords are required just to touch the bottom of the grooves on the bobs. For facilitating adjustment in this respect the ends of the cords are attached to lever arms *K* formed on spindles pivoted between the members *E*. Opposed arms on these spindles are acted upon by the ends of small screw handles *L*.

Coming now to Fig. 2, an elevation of the left-hand side of the car, we have the side frame at *B*, the pendulum bob at *G*, and the cord at *H*. It will be understood that in every respect the right-hand side mechanism is the duplicate of that on the left. The cord *H* is connected through a spring to the end of a lever *M* pivoted at *N* to a standard *P* erected on the side frame *B*. The lever *M* extends beyond the pivot *N* and at *Q* is pin jointed to an arm carrying a segmental rack *R*. A rod *S* connected to this arm extends backward and passes through a bush carried at the top of a standard *T* fixed to the side frame *B*. On each side of the bush the rod is provided with a spring and a collar. *U* is a pinion which will be referred to later on. *V* is a spring which is attached to the lever *M* and the standard *P*, and which serves to keep the cord *H* taut.

Let the car swing over to the right-hand side. The right-hand bob *G* will leave its cord *H* (see Fig. 1) and the left-hand bob will press against its cord. The pressure on this cord (see Fig. 2) is transmitted to the lever *M*, causing the end *Q* and therefore the rack *R* to rise upward. When

(*Concluded on page 453.*)

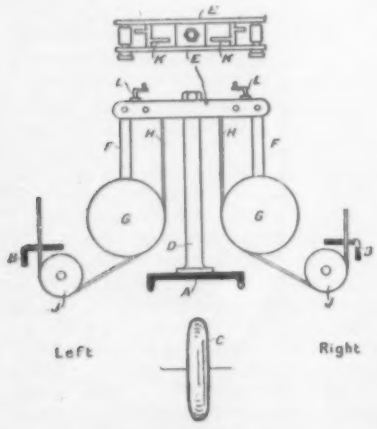


Fig. 1.—Partial cross-section of car.

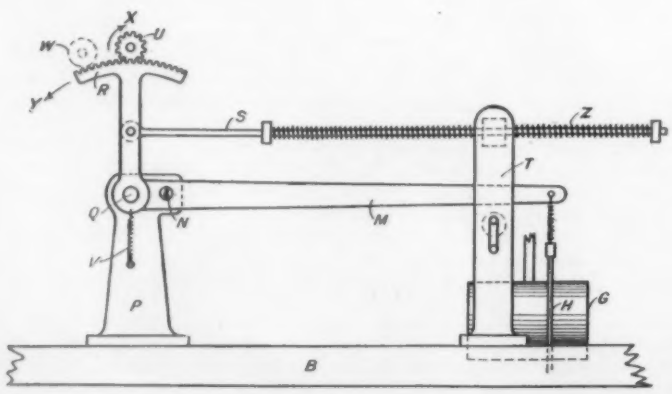


Fig. 2.—Elevation of left side of car.

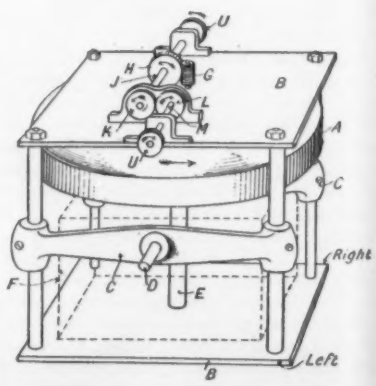


Fig. 3.—Details of gyroscope.

Training Wild Animals for Moving Pictures

By Robert H. Moulton

STRONG, ambitious wild animals, that until now have hoped for fame only in the circus or on the vaudeville stage, have found a new field for exercising their talent. A private dramatic school has been established near Fort Lee, New Jersey, which devotes its time exclusively to training beasts for the moving picture stage. Paul Bourgeois, a young French animal tamer, first thought of teaching the jungle inhabitants to appear before the camera, and he immediately founded the school of which he is still director.

This entire institution seems unusual to a regular patron of the "movies." A short distance out of Fort Lee one comes upon a low, one-story building, standing in the center of a small wood. A knock at the door brings M. Bourgeois himself, for he is gratified to show visitors through his unique educational establishment. The door leads almost directly into the studio. This apartment, where the pictures are made, is equipped with a stage, scenery, and skylight, all essential to the operation of any moving picture plant. The animals are kept caged in a large menagerie adjoining the studio, and are taken out only for the daily rehearsals. With a few slight exceptions, the principles of animal posing and human acting are the same. When a film requiring beasts is to be made, the animals are first trained regularly in their simple movements until the performance becomes a habit, since they can respond only to instinct, not to intelligence. Originality must be used by the trainers to make their charges do the right thing at exactly the proper time for the camera man. For this purpose common devices are coating tree branches with honey to keep Bruin aloft the entire length of a scene, or exposing a chicken off the stage when the fox should jump out of a window. The animals feel at home only in the studio of the school, and consequently, the company of human actors must go to Fort Lee when a film is made.

A marvelous circumstance of the profession, for which M. Bourgeois himself can hardly account, is that these so-called dangerous beasts rarely attempt to harm their fellow actors. In fact, no person has been injured by any animal in the New Jersey school. Women, maintains the director, seem even more fearless than men. To prove this assertion, M. Bourgeois describes the production of "Beasts of the Jungle," a popular film at present. In one scene a small, young actress with complete security nestled up close to Princess, a huge tigress, while several stage hands and moving picture employees, with less confidence, nervously held revolvers leveled at the animal.

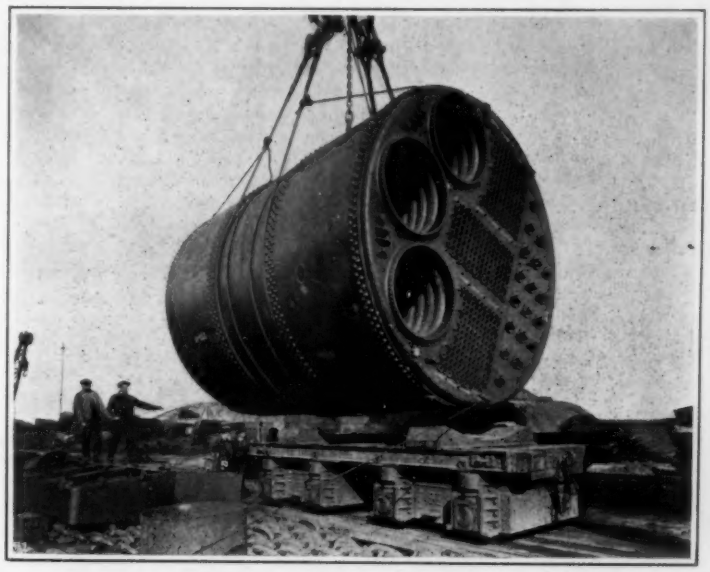
An interrupted shave. A humorous scene from a wild animal moving picture film.

An Unattended Lighthouse

By H. J. Shepstone

ALTHOUGH every civilized nation possessing a coast line has now a number of automatic light buoys and even beacons, the only unattended lighthouse built on a wave-washed rock boasting of a powerful fog signal and all the apparatus associated with a fully equipped light station is the recently completed Platte Fougère tower, marking the entrance to Russell Channel, which leads to St. Peter's Port, the capital of the island of Guernsey, in the English Channel. The tower guards dangerous reefs which have for years been a menace to shipping, more particularly in foggy weather than at night. The tidal currents and the great rise and fall of the tide, with its swing of 30 feet at this spot, also makes navigation extremely difficult.

The possibility of erecting a stone tower to accommodate keepers was soon found to be out of the question, not only owing to the great cost that would be involved in constructing a rock lighthouse that men could live in, but also on account of the small area of the rocks. The difficulty was overcome by equipping one of the rocks with an 80-foot tower large enough to hold motors, compressors, fog horn and light, which are all controlled by a submarine cable from the shore. This lighthouse, with its wonderful array of electrical devices for warning and guiding the mariner through the dangerous channel, rises from a rock known as Platte Fougère, always submerged except at low water.



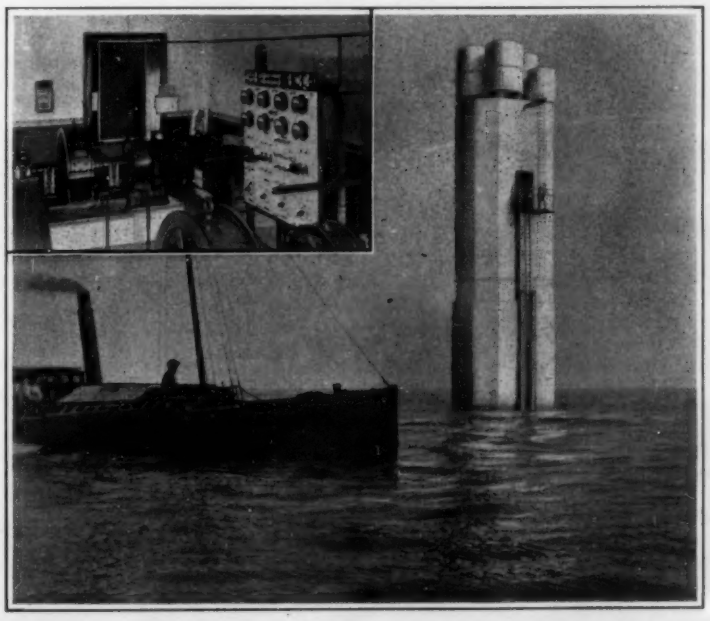
One of the "Britannic's" twenty-nine, 105-ton boilers.

On the entrance level is a compartment containing an electric motor and air-compressor, while on the floor immediately above is a duplicate installation. The syren projects through the top of the tower, the trumpet being so turned as to throw the sounds in a horizontal direction over the water. On the top of the tower is a small automatic acetylene gas plant and lamp. All these devices, many of which are the invention of Mr. E. C. Catford, are controlled from the shore station, 1¼ miles distant, by means of a submarine cable specially made for this work. In fog it is desirable to know that both light and fog signal are working satisfactorily. Accordingly Mr. Catford designed special alarms which would inform him of their behavior. At a distance of some 15 feet from the lantern he placed a selenium cell electrically connected with an alarm bell in the shore station. So long as the light flashes every ten seconds on the cell the bell does not ring, but should fog obscure the light or the light go out for any reason, the bell at once commences to ring, thus giving the alarm. In the same way a bell rings in the engine room at every blast of the syren. The signal comes instantaneously, the actual sound of the blast itself reaching the shore five seconds later.

Another device is the telephone which has been installed in the tower for the use of pilots and others. It is the only ocean telephone call office in existence. It is principally used by pilots to announce to the authorities the approach of mail boats during foggy weather. They simply climb the ladder of the tower and ring up the exchange.

The shore station is situated at a point known as Doyle Fort. Here a dwelling has been erected for the keepers, adjoining which is the engine house. The machinery includes two oil-engines which drive three-phase alternators, and an air-compressor for working the land syren should that be required. In the tower itself there is a simple switch operated by an electro-magnet, whereby motor-driven air-compressors are thrown in and out of action. Thus, at night the light can be automatically turned on, and at sunrise automatically extinguished. In the same way the fog signal can be set in motion or be discontinued at will.

The cost of the tower and its complete installation was $55,000, which may be considered a small figure when the exceptionally difficult nature of the situation is considered, as well as the powerful nature of the fog signal which has been erected, and the fact that an ordinary rock lighthouse establishment would have cost about $300,000. There is also the saving in maintenance, as only two keepers are required in place of four. Indeed, the Platte Fougère unattended lighthouse has solved a vexed problem how to warn mariners of the presence of dangerous rocks at a minimum of expense.



The unattended lighthouse at Platte Fougère in the English Channel. Motors, compressors, fog horn, and light are all controlled by a submarine cable leading to a shore station 1¼ miles distant.

The Boiler Plant of the "Britannic"

THE twenty-nine huge boilers of the 50,000-ton White Star liner "Britannic," now under construction at Belfast, were recently placed in position. Twenty-four of these are double-ended and five are single-ended, all being designed for a working pressure of 215 pounds, which has been found entirely practicable under natural draught conditions. Owing to the "Britannic's" great breadth it has been found possible to arrange five boilers abreast, except in No. 6 boiler room, where, because of the increased fineness of the hull, only four could be placed. All the double-ended boilers are 15 feet 9 inches in diameter, weigh 105 tons each, and are constructed of steel 1 11/16 inches thick. Each boiler has 159 furnaces of the Monson type.

The "Britannic's" boiler installation and the coal bunkers occupy six watertight compartments, extending for a total length of 320 feet; the engine room takes up 123 feet additional o. the 900 feet of length of the ship.

The "Brittanic's" engines, like those of "Olympic," will consist of a combination.

of two reciprocating engines in the wings, with a low-pressure turbine of the Parsons type placed amidships. The superior economy of this system is due to the fact that increased power is obtained, on the same consumption, by expanding the steam in the low-pressure turbine beyond the limits possible in reciprocating engines. This economy has been proved in the voyages of the White Star liners "Laurentic" and "Olympic."

Iron Ore, Pig-iron, and Steel Production

By Henry Harrison Suplee

DURING the year 1912, according to the report of the United States Geological Survey, the production of iron ore, and the resulting pig-iron and steel, showed a marked increase over the preceding year. The total quantity of iron ore mined amounted to 55,150,147 long tons, or slightly more than 25 per cent more than was mined in 1911, and the amount marketed was about 57 million tons, valued at 107 million dollars.

The amount of pig-iron manufactured during 1912, including the various ferro-alloys, such as spiegeleisen, ferromanganese, etc., was 29,726,937 long tons, which was again rather more than 25 per cent increase over 1911. The amount of pig-iron marketed in 1912 was about 30 million tons, having a value at the furnaces of more than 420 million dollars.

Practically all of this iron, together with a small quantity of imported material, was manufactured into steel, the steel production of the United States during 1912 being a little more than 31 million tons, which, at the market price of $28 per ton for steel rails, gives a value of 868 million dollars.

These figures show that 107 million dollars worth of iron ore is increased four times in value when converted into pig-iron, and more than eight times when transformed into steel, an excellent example of the manner in which human effort adds to the value of natural resources.

In order to give some idea of the volumes which these figures represent, we may take the iron ore as weighing 235 pounds per cubic foot, when 57 million tons would occupy a space of 543 million cubic feet, corresponding to a cube with edges 816 feet in length, or a cube higher than the Woolworth building in New York.

When reduced to pig-iron, increasing in value four times, the volume becomes about 150 million cubic feet, corresponding to a cube 532 feet high, or nearly that of the Washington monument at the National Capital. The conversion into steel, doubling the value, and raising it from about 100 million to more than 800 million dollars, reduces the volume to about 145 million cubic feet, or a cube 525 feet high.

These figures are better grasped by comparison with various large structures, and we may use the new terminal station of the Pennsylvania Railroad in New York. This covers an area of about 450 feet by 850 feet, or 382,500 square feet. The iron ore mined in the United States in 1912 would cover this area to a height of 1,420 feet, or double the height of the Metropolitan tower in New York, while the pig-iron would require to be piled in a solid mass 400 feet high to include the production of the past year in America.

It is interesting to note that of the 31 million tons of steel made in the United States in 1912, only about one third was made by the Bessemer process, the remaining two thirds being open-hearth steel. Until 1907 the preponderance was in favor of steel made by the Bessemer process, but in that year the open-hearth product equaled that of the Bessemer converter, and it has maintained a steady lead ever since. About 42 per cent of the iron manufactured was produced in Pennsylvania, and 23 per cent in Ohio. Illinois makes 9.7 per cent, while New York and Alabama were close rivals for the fourth place, New York being slightly in the lead.

More Power from the Rhine.—The amount of power taken from the Rhine for electrical purposes is already considerable, and this is now to be increased by new plants which are to be erected. Starting with the 15,000 horse-power of the Rheinfelden station, two new plants were then put up at Augst and Wyhlen, giving together 30,000 horse-power and distributing current over a large area. But the largest plant of all will be built upon the upper Rhine, and it will furnish no less than 60,000 horse-power, making use of the part of the stream lying between Albbruck and Schäffigen. The new plant is to have 10 turbines of 5,000 or 6,000 horse-power each, and three of the alternators of three-phase type coupled to the turbines will give 5,200 kilowatts, while the other three are rated at 6,150 kilowatts. Such alternators represent the most recent designs for this class of machine, and run at 107 revolutions per minute, working at 6,000 to 6,600 volts. Current will be sent over power lines at 47,000 and 78,000 volts by the use of step-up transformers in the station.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Latin-American View of the Problem of Our Navy

To the Editor of the SCIENTIFIC AMERICAN:

I am sorry to note that your valued articles dealing with "The Problem of Our Navy" have been brought to a conclusion.

The continuance of such articles is the only way to bring to the mind of the people of the United States that the Navy can be made practical; that it is a school for poor young men who lack educational opportunities; that it gives them a discipline second to none, and most of all, that the first-class policies of the United States, namely, Indivisibility of China, Asiatic Exclusion, the Monroe Doctrine, etc., can only be enforced by a large and strong navy.

This Monroe Doctrine, which has kept many a Latin-American republic from the jealous eye of the European powers, can only be maintained by a navy large and strong enough to make war with the United States a difficult task for these European powers, being as they are, 3,800 miles away from their main naval bases, but with a great preponderance of capital ships—dreadnought type—this task could be accomplished by such powers.

All this you and the Secretary of the Navy have explained wonderfully well in your several articles.

If you were to ask all the more educated class of Latin-Americans what is the object of the great naval programme which Germany has started a decade ago, the answer would correspond with yours: The Monroe Doctrine, the Panama Canal, and her great commercial interests with Central and South America.

I am positive that the better class of Cubans and Latin-Americans are more interested in the increase and efficiency of your Navy than the average inland citizen of the United States. Your Navy is the only friend that we Latin-Americans have that can keep the greedy hands of the nations of the Old World away from us, and dropping fast as she is to a fourth-class navy (not to a third-class as you say), we stand helpless at their hands in the event they should attempt conquest.

I noted in your recent articles that you often spoke of a first-class navy, that of England with forty-two dreadnoughts built and building; a second-class navy, that of Germany with twenty-six dreadnoughts built and building; and a third-class navy, that of the United States, with thirteen dreadnoughts built and building, with France and Japan close behind with eleven and ten of these ships, respectively. Permit me to say that you have not done justice to France. Perhaps it was an oversight on your part. The modern French navy will be, I am sorry to say, superior to that of the United States. I shall make here a *rough comparison* of capital ships built, building, and authorized by both nations:

United States Ships.

	Tons. Main battery.		
2 "Michigans"	 32,000	16	12-in. guns
2 "Delawares"	 40,000	20	" "
2 "Floridas"	 43,650	20	" "
2 "Arkansas"	 52,000	24	" "
2 "New Yorks"	 54,000	20	14-in. "
2 "Oklahomas"	 55,000	20	" "
2 "Pennsylvanias"	 62,000	24	" "
Total tonnage	 338,000		

French Ships.

	Tons. Main battery.		
4 "Jean-Barts"	 94,000	48	12-in. guns
3 "Bretagnes"	 70,500	30	13.4-in. "
4 "Normandies"	 101,548	48	" "
4 (New ones)	 116,000	64	" "
Total tonnage	 382,048		

Assuming the weight of the 12-inch projectile of the United States and French navies to be 870 pounds; the weight of the 14-inch American projectile to be 1,400 pounds; and the weight of the 13.4-inch French projectile to be 1,433 pounds, in comparing gun power, we see that a single discharge of all the big guns of the 15 dreadnoughts of the French navy would throw a shower of deadly material weighing 245,246 pounds on a target of fourteen American ships, as against a discharge of 159,200 pounds of metal of one single round fired from all the big guns of the fourteen dreadnoughts of the American Navy, on a target of fifteen French ships. This shows a superiority of the French ships of 54 per cent in gun power, regardless of the fact that the projectile of the 13.4-inch gun of the French navy, although of less diameter, has a greater muzzle velocity, and being heavier, is consequently more powerful than the 14-inch American gun. Of these large guns the American ships are equipped with sixty-four, as against one hundred and forty-two on the French ships. It must be borne in mind also that the two "Michigans" have less speed, and that the two "Michigans" and two "Delawares" are not as heavily armored as the four smaller French ships of the "Jean-Bart" type; namely, the "Jean-Bart," "Courbet," "Paris," and "France."

The United States, therefore, stands now as a fourth-class naval power in modern ships. In this *rough comparison* of gun power and tonnage, I have not included the battleships of the pre-dreadnought type, of which the United States has a great superiority, but no nation that looks forward to a first-class line of fighting ships would look upon them for reliance in future naval battles.

My only aim in bringing this comparison to your mind is to show you that as the matter now stands, the United States is dropping as a naval power at a higher rate than it is generally believed in your country, and which is looked at with regret.

Are many Americans also aware of the fact that the Italian government has eight dreadnoughts built and building, and is now considering the construction of four 35,000-ton ships, each carrying twelve 15-inch guns in four triple turrets, the projectile of which guns weighs 1,950 pounds; that the Spanish government has just voted a credit of $324,000,000 for the construction of dreadnoughts, scout cruisers, destroyers, etc.?

I, therefore, encourage you, Mr. Editor, to have this subject of the Navy on your publication every now and then, until you have convinced your people and your country of the necessity to build and keep a *second-class navy*, such as you had in 1906, to maintain peace, not to make war.

Please accept my heartiest thanks for your valued literature, and that of the Hon. Josephus Daniels, Secretary of the Navy, dealing with the subject mentioned above, which is of vital importance to your country, and to all America.

Since I am a foreigner, I must ask your pardon for my poor English. IGNACIO VALDÉS.

Hormiguero, Cuba.

The Tide-predicting Machine

To the Editor of the SCIENTIFIC AMERICAN:

Please grant me space in your journal to make the following statements in reference to a note in your issue of May 2nd, 1914, page 362, headed "The Tide Predicting Machine" and signed by R. A. Harris:

I do not wish to make reply to or discuss the contents of that note. But, in order to prevent silence being interpreted as acceptance of the position assigned me therein, I beg to state:

The C. and G. S. Tide Predicting Machine No. 2 is one of the products of the Coast and Geodetic Survey. The officials of that Bureau are thoroughly familiar with its development from its first inception, prior to 1890 (the year in which Dr. Harris entered the service), to its final completion. They accorded the undersigned the honor to publish a description, under his name, in *Engineering News*, issue of July 20th, 1911, and in the *Journal of the Washington Academy of Sciences*, issue of July 19th, 1911.

The various statements in Mr. C. H. Claudy's article in your issue of March 7th, 1914, are substantially correct, though his references to the undersigned are unduly laudatory. E. G. FISCHER.

Washington, D. C.

The Current Supplement

OUR SUPPLEMENT, No. 2004, brings an illustrated description of the Westinghouse marine turbine.—Dr. F. A. Woods contributes a study on the racial origin of successful Americans.—Prof. G. G. Scott writes on the relation of aquatic animals to the surrounding water.—L. B. Ward gives an account of this year's additions in the United States Navy.—M. v. Jakubowski describes the mining and other methods of obtaining amber on the Baltic coast.—J. J. Smith discusses the power required for refrigeration.—J. H. B. Bryan describes the building of large gas engine flywheels.—In an article on the stability of ships' lifeboats the decked type of boat is recommended, the common type affording little protection even in a fairly good sea.

The Forthcoming Trials of Langley's Machine

LANGLEY'S full-sized aeroplane, on which the United States Government spent more than $50,000, was brought to Hammondsport six weeks ago. In the next number of the SCIENTIFIC AMERICAN we expect to publish a complete illustrated account of these trials from the pen of a special correspondent at Hammondsport.

Our Navy and the Mexican Situation

IN the first of our series of articles on "The Problem of Our Navy," written by the Assistant Secretary of the Navy, the Hon. Franklin D. Roosevelt, we published a map showing the disposition of the ships of the United States Navy on February 12th of this year. This map served to illustrate the fact, which was brought out by Mr. Roosevelt in his article, that not only in the stress of wartime, but also in days of peace is our Navy very actively employed. On the day named, there were stationed on the Gulf and Pacific coasts of Mexico, at its various ports, some fourteen or fifteen United States war vessels.

Since the date of that article, the Mexican crisis has become so acute and events have moved so swiftly that, to-day, there are gathered at the various Mexican ports no less than eighty-three ships, in which is included the very flower of our Navy. In this fleet are included eight dreadnoughts, ten pre-dreadnoughts, four armored cruisers, one modern monitor, our three fast scouts, four protected cruisers, twenty-three of our latest destroyers, four gunboats, four third-class cruisers, seven colliers (these the largest and fastest of their class to be found in any navy of the world), one mining ship, two auxiliary cruisers, four large seagoing tugs, one refrigerating ship and six miscellaneous vessels of the auxiliary type.

The events which have led to this great naval demonstration are so well known as to call for no recapitulation here; but we do wish to emphasize the fact that, when the President, realizing that matters between the United States and Mexico had reached that critical line where diplomacy gives way to naval and military force, called for the dispatch of the Atlantic fleet to Vera Cruz for the seizure of that port, the Navy was prepared to make a quick response. The Atlantic fleet concentrated on Vera Cruz with highly commendable rapidity; the seamen and marines were landed; and before many hours had elapsed, the port was in our possession and the work of disarming the populace, seizing the water-works, and throwing out around the city a cordon of outposts was under way. The work was done with a neatness and dispatch which proved that, for work of this character, our Navy is in a condition of very high efficiency.

The seamen and marines, some six thousand of them, received their baptism of fire under difficult and very disconcerting conditions, the enemy being concealed, for the most part, within houses, or protected by the high parapets of the roofs. Nevertheless, the accounts agree that these young men went through the ordeal with all the steadiness of veteran forces. The severity of the fighting is shown by the fact that on our side alone some twenty lives were lost, and about three times that number were wounded. The Mexicans are estimated to have lost some 200 men.

Following immediately upon the occupation, Admiral Fletcher put in hand the work of restoring order and confidence, with the result that Vera Cruz quickly settled down to its routine of daily life—and this under conditions of security which it had never known in all the centuries of its existence.

We have received a personal letter from the captain of one of our ships, which pays such interesting tribute to the work of the Navy down there, that we venture to publish the following excerpt:

"I have just returned aboard after commanding one of the regiments of bluejackets. The embarkation of the 6,000 sailors and marines was astounding. We passed in review before the Army and Advance Base Marines, and went aboard tugs and steamers. In 35 minutes from the signal to begin moving, the force was clear of the dock and bound back to the ships.

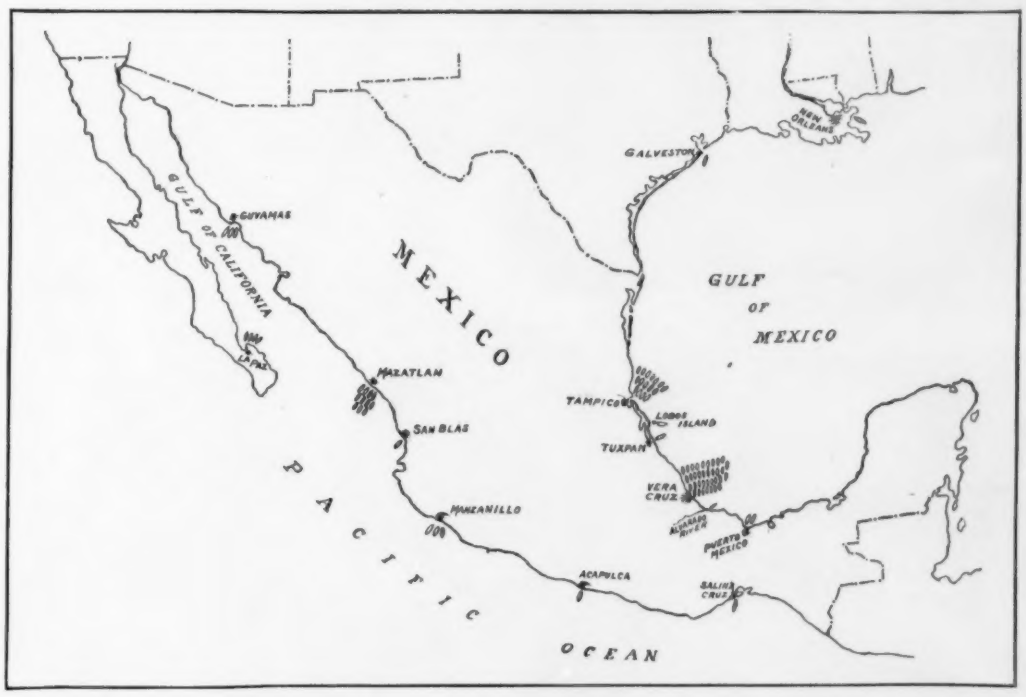
"The Supply Department was beautifully handled by our paymasters and marine officers. The cooking was excellent—meals served promptly—although everything was improvised out of very little in the way of stores and means of cooking. It was a triumph for our Commissary System.

"Our men behaved *absolutely*. We cleaned the city of all firearms, weapons, and ammunition; and we cleaned the streets. What New York, Washington, and Philadelphia need is an effective street-cleaning department such as we put into Vera Cruz, something which our city governments seem to be powerless to organize and keep in *successful* operation."

This fine tribute is in line with Admiral Fletcher's modest praise of the marines and bluejackets, when he said: "In nine days' work Vera Cruz was occupied by the Navy, lawlessness and disorder suppressed, 11,000 firearms taken possession of, and a line of defenses established around the city against an army threatening to recapture it. Business was resumed and normal conditions restored."

Later Gen. Funston reached Vera Cruz with a force of 4,000 men of the Regular Army, which, at the present writing, is in occupation of the city.

For the next few weeks, the center of interest will be found at the Niagara Peace Conference.



Map showing location of the ships of our Navy at Mexican ports on May 20th, 1914.

The Wreck of the Forlanini Airship "Citta di Milano"

FROM the London *Engineer* we glean some details of the disaster which befell the Forlanini airship "Citta di Milano," on April 9th. The disaster is to be attributed not to any defect in design but to the stupidity of the populace among whom the craft was forced to descend. In order to repair a leaky valve, the airship was brought to the ground after she had left her shed, and moored to some trees with ropes partly of hemp and partly of steel, having a breaking strength of five tons. Before the necessary repairs could be made to the valve, the ropes gave way and the airship was driven for about 170 yards against some mulberry trees. She was again moored, and the commanding officer decided to deflate the bag. A crowd of peasants gathered to watch the operations. The soldiers could not drive them back. Indeed, they could not be even made to give up smoking. As the deflated bag fell over toward the crowd on the left side, several explosions followed hard on one another. A great blast of blue flame shot out from the airship, and passing away left behind nothing but a twisted mass of framework and a struggling body of human beings. About eighty people were more or less seriously injured. Thus through the crass obstinacy of a few yokels a vessel presented to the government by public subscription at a cost of $80,000 was destroyed beyond repair. The airship had had a life of nine months, had made many successful voyages, and like her fore-runner, the "Leonardo da Vinci," had been singularly free from accident.

The Iron Smelter's Fuel Bill

By Henry Harrison Suplee

FEW people realize the magnitude and importance of what may be termed a secondary industry in the United States—the manufacture of coke. The removal of injurious substances, with respect to metallurgical purposes, by driving off the sulphur and other volatile constituents from coal by the operation of coking, forms one of the important elements in the iron industry, since by far the greater portion of the coke made is intended as fuel for blast furnaces used in the smelting of iron ore.

In the year 1912 the quantity of coke made in the United States was 43,983,599 short tons, according to the report of the United States Geological Survey, or in round numbers, about 44 million tons. This corresponds to more than 3,000 million cubic feet, and would fill a cube of 1,442 feet length on each edge, or twice the height of the Metropolitan tower in New York.

The coal from which this coke was made, 65,577,862 tons, would fill 1,311,500 cars of 50 tons capacity, making, if coupled up in one train, a length of 8,700 miles, extending from New York to San Francisco and all the way across the Pacific Ocean.

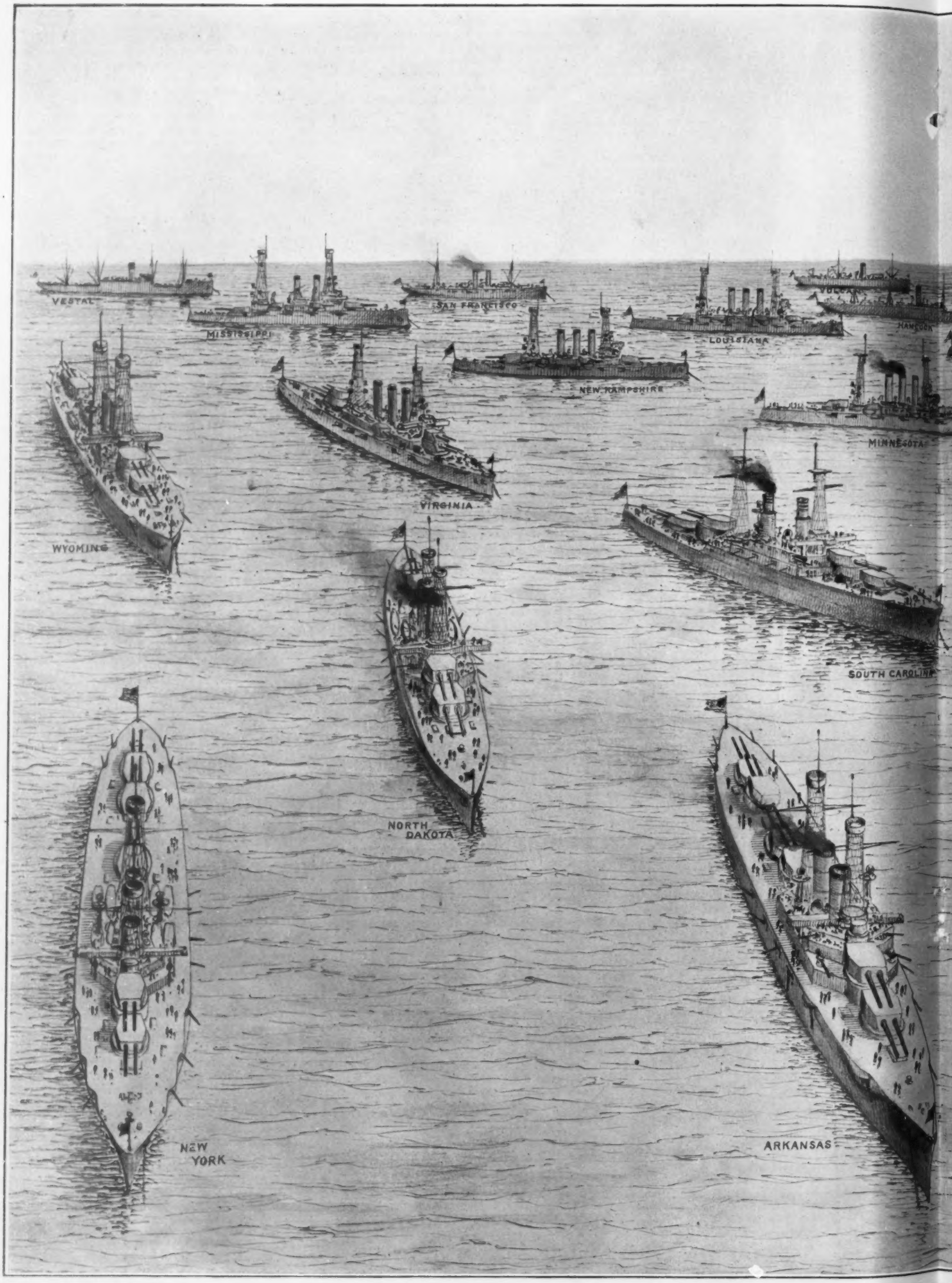
This coal is valued at about 87 million dollars, while the coke made from it was sold for more than 111 million dollars, an increase in value of more than 27 per cent. Less than four years' production of this amount of coke would equal in value the entire cost of the Panama Canal, including sanitation and the purchase price to the French company.

During the year 1912 there was a notable increase in the proportion of coke made in by-product ovens. Formerly all the coke made in America was made in the inefficient beehive oven, all the gas and ammonia going to waste. Last year, one fourth of the entire quantity was made in by-product ovens, the coal being coked in retorts, which enabled these valuable products to be saved, a portion of the gas being burned as fuel for the coking, and a large amount being sold for other purposes. At the present time about fifty million cubic feet of illuminating gas per day is produced as a by-product of coke ovens, supplying such cities as Boston, Indianapolis, Baltimore, and Milwaukee.

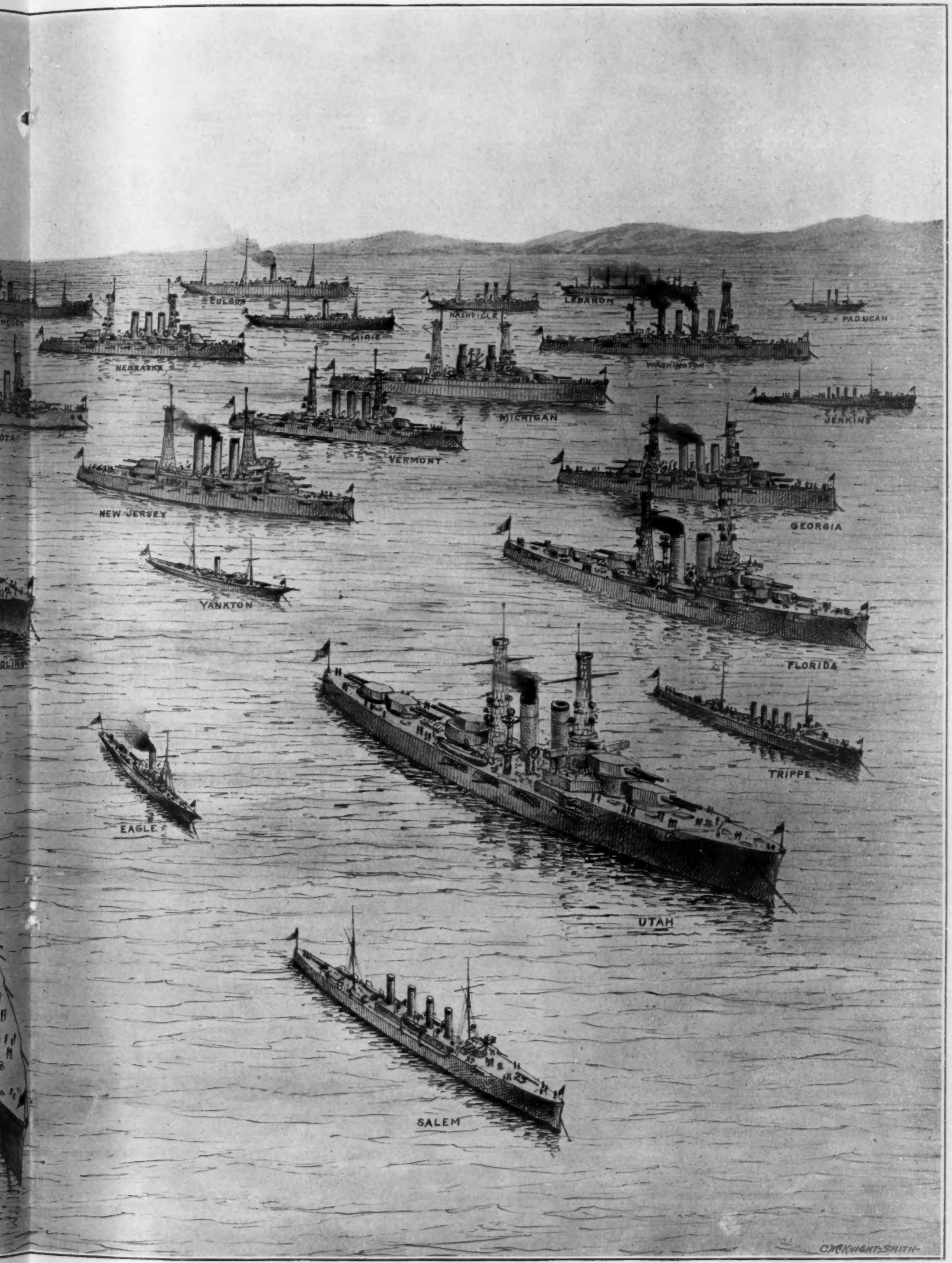
From the eleven million tons of by-product coke made in the United States, there was derived sixteen million dollars value of by-products consisting of gas, tar, and ammonia. Since the coke itself had a value of forty-two million dollars, there was added 38 per cent value to the product by the recovery of valuable products formerly thrown away. If efficiency is rightly defined as reduction of waste, there is here a most notable example of modern efficiency. A similar gain, applied to the coke made in the wasteful beehive ovens, would represent more than twenty-five million dollars, without taking into account the greater value in the improved quality of the coke itself. In this connection attention may be called to the emphasis laid by Dr. Diesel upon the efficiency attainable by using gas tar as a fuel for Diesel engines. He maintained that if all coal was refined by coking, the power developed from the gas and the tar would equal that which could be derived by burning all the coal under boilers, while the coke would remain available for metallurgical purposes and such uses as would still require solid fuel.

The South Magnetic Pole

A JOURNEY to the region of the south magnetic pole was made by Lieutenant Bage and Messrs. Webb and Hurley, of the Mawson expedition. Observing stations were established every 10 miles along the journey of 300 miles from Winter quarters, in spite of the extremely rigorous climatic conditions. The readings showed strong local variations in magnetic force, but on an average the dip of the magnetic needle increased about one minute of arc for every 3 miles. From the observations it appears that in December, 1912, the approximate position of the northwestern edge of the magnetic polar area was in latitude 70 degrees 36 minutes S., longitude 148 degrees 12 minutes E. This differs by over 100 miles from the position of the southeastern boundary of the area, as determined by David and Mawson in January, 1909, during the Shackleton expedition. Webb provisionally estimates the width of the area in a SW-NE direction to be about 40 miles. If this estimate is correct, and if the positions were accurately determined in 1909, the polar area must have shifted materially since that time.



BIRD'S EYE VIEW OF THE FLEET OF UNITED STATES SHIPS



TATES SHIPS ASSEMBLED AT VERA CRUZ, ON MAY 20TH, 1914.

The Heavens in June

New Comet Discovered—Counting the Stars

By Henry Norris Russell, Ph.D.

THE second comet to be discovered in 1914 was found by Zlatinsky, at Meitau, Russia, on May 16th, in the northern part of Perseus, almost due north from the Sun. It was unusually bright for a newly discovered comet, being visible to the naked eye, according to the first report, and in an opera glass, according to the next day's telegram. Only the first two days' observations are at hand when this must be written; but they suffice to tell a good deal about the comet.

On the 16th of May it was in 3 hours 18 minutes right ascension and 49 degrees 51 minutes north declination, within a fraction of a degree of the bright star Alpha Persei. The next night it had moved westward by nearly 21 minutes of right ascension, which (in this declination) amounts to about 3 1/3 degrees in the sky, while it had gone northward by but 7 minutes of arc.

Its apparent direction of motion is straight toward Capella, and its rate such that, if moving uniformly, it would reach the neighborhood of the latter star in about six days. At present it is equally well, or ill, to be seen in the evening or morning sky, being some 10 or 15 degrees high in the northwest when the sky grows dark, grazing the northern horizon at midnight, and coming up in the northeast before dawn. For observatories in northern Europe it is circumpolar, and 10 degrees or more high at midnight, so that they have a far better chance of observing it than we have. But in a week or so it will be much higher in the evening sky, and there should be no trouble in observing it.

Nothing can yet be said concerning its orbit, though the facts will be known within another week. But from its rapid apparent motion it can easily be shown that it must be within 75 million miles of the Earth, and not less than 45 millions from the Sun, and also that its motion must be in the opposite direction from that of the Earth.

It may be much nearer to us than the limit just mentioned; but this must remain uncertain until detailed calculations are made. The circumstances are unfortunately such that it is still impossible to say, even roughly, where the comet will be in the sky by the first of June, or even whether it will be brighter or fainter then than at the time of discovery.

Kritzinger's comet has been favorably placed for observation during the present month, and will be almost as well in June. On the 2nd of June its predicted position is in right ascension 20 hours 54 minutes, declination 41 degrees 30 minutes north—about 5 degrees southeast of Alpha Cygni. It is then moving eastward and a little northward, at a little less than 1 degree a day. By a rough extension of the published ephemeris, it appears that on the 16th it should be approximately in 21 hours 48 minutes plus 44 degrees 35 minutes, and on the 30th in 22 hours 30 minutes plus 46 degrees. Its brightness will even then be about two and one half times that at the time of discovery, but as it was then described as fainter than the ninth magnitude, it will not, even at best, be a conspicuous object in a small telescope.

Delavan's comet is slowly coming out into the morning sky, but is not observable yet. Its position on June 18th is given as 4 hours 28 minutes plus 26 degrees 12 minutes, which would make it rise 1 hour and 20 minutes before the Sun. It will be observable once more in July, but will not become conspicuous till later in the year.

It has been customary to comment here upon the astronomical literature of the past month; and for mention this time we may well take one of the numerous pieces of good work which are now coming from the University of Lund, in southern Sweden, where Prof. Charlier has gathered around him a group of able students.

Fortunately for astronomers in most countries, these publications, though bearing the title, "Meddelanden fran Lunds Astronomiska Observatorium," are written sometimes in German, but often in excellent English, as is the case with the work under consideration by Dr. Hans Henie.

Dr. Henie has set himself the problem of determining the number of stars in the sky brighter than the eleventh magnitude, and the density with which they are distributed, per square degree, in the various parts of the heavens.

As material for his investigation, he employed the well known "Harvard Sky," a series of fifty-five plates, taken at Harvard and Arequipa, Peru (which among them cover the whole heavens from pole to pole), of which duplicates have been furnished to many observatories.

The first thing to do was to count the number of star-images shown on these plates. Dr. Henie ingenuously remarks: "As the number of stars was about one and one half millions, I refrained from counting them all." Instead of this, he mapped out a series of one hundred squares, one centimeter on a side, distributed evenly over each plate, and covering about one quarter of its area, and counted the stars in these squares. The average number of stars per square was 78, and the whole number of stars counted no less than 425,497. In one region in the Southern Cross, nearly 2,000 stars were counted in a single square.

The next problem was to find out how faint were the faintest stars shown on each plate. This was made relatively easy by the fact that, in the regions of the sky surrounding a large number of variable stars, the brightness of a sequence of faint stars has been measured. By identifying these stars on the plates, the magnitude of the faintest stars visible could at once be determined. But this was not the whole story, for it was found that much fainter stars were shown near the center of each plate than at its edges, and corrections had to be made for this, which was successfully accomplished by a very ingenious method. After this has been done, the number of stars in each region which are brighter than the eleventh magnitude can be calculated. Dr. Henie finally concludes that the whole number of stars in the sky above the eleventh magnitude is 1,013,328, or an average of not quite 25 per square degree, which is equivalent to a little more than five such stars in an average bit of sky as big as the full Moon. But the number of stars per square degree varies enormously in different parts of the sky. The regions poorest in stars are in Ursa Major, in about 9 hours plus 50 degrees, and again in about 13 hours 30 minutes plus 57 degrees, in each of which there are less than five stars per square degree brighter than the eleventh magnitude. The whole region occupied by the Great Dipper (which lies between the two positions just mentioned) is very poor in telescopic stars.

The richest regions are in Ophiuchus in 18 hours 20 minutes plus 2 degrees, where there are actually 112 stars per square degree above the assigned limit of magnitude, and in Cygnus (21 hours 8 minutes plus 52 degrees) with 105 stars per square degree. Regions almost as rich are found in Sagittarius (17 hours 40 minutes minus 27 degrees) and Argo (9 hours 40 minutes minus 62 degrees). All these rich regions lie in the Milky Way, while the poor ones are near its pole. The average number of stars per square degree in the Milky Way is more than forty, while near its northern pole it is about seven. Near the southern galactic pole, curiously enough, the number of stars per square degree is about twice as great.

There is little doubt that if similar counts could be extended to still fainter stars, the increase of their numbers toward the Milky Way would be still more marked.

At 11 o'clock : June 7.
At 10½ o'clock : June 14.
At 10 o'clock : June 22.

At 9 o'clock : July 7.
At 8½ o'clock : July 14.
At 8 o'clock : July 22.

At 9½ o'clock : June 30.

NIGHT SKY: JUNE AND JULY.

The Heavens.

The rich regions of the Milky Way, of which we have just been speaking, are now conspicuous in the eastern and southeastern sky, though the vast agglomerations of still fainter stars which form the great clouds extending from Aquila to Scorpio are even more prominent. Among the brighter stars, too, many of the finest groups will be found in this region; Cassiopeia, low in the northeast; Cygnus and Lyra, a little north of east; Aquila, farther to the southward; and then Sagittarius and Scorpio, the latter extending to the meridian. Ursa Minor and Draco are in the north, above the pole. Hercules and Corona are right overhead, with Ophiuchus and Serpens to the southward. Arcturus shines splendid, high in the southeast, and Spica, apparently fainter, but far more remote, and really brighter, appears below. Leo is low in the west, and Ursa Major well down in the northwest, and sinking steadily.

The Planets.

Mercury is an evening star all through June, and is well observable in the earlier half of the month, setting at about 8:45 P. M. on the 1st and 9:10 on the 18th, when he is at his greatest apparent distance from the Sun. After this he moves southward, and becomes less easy to see; setting about 8:30 at the end of the month. On the 1st he is brighter than Arcturus; but as his crescent narrows he grows fainter, and by the end of the month he is fainter than Regulus.

Venus is likewise an evening star, setting about 9:30 all through the month, and is very conspicuous.

Mars, too, is visible in the evening, but is higher in the sky, setting about 11 P. M. on the 15th. He has fallen off very much in brightness, and is now no brighter than the brightest stars of the Great Dipper.

Jupiter is still a morning star, but is growing more conspicuous. He is in the eastern part of Capricornus, and rises near midnight on the 1st, and a little before 10 P. M. on the 30th.

Saturn is in conjunction with the Sun on the 13th, and cannot be seen this month.

Uranus is in the middle of Capricornus, and rises about 10:15 P. M. in the middle of the month. Neptune is in Gemini, and sets at about 9:30 P. M. on the same date.

The Moon is in her first quarter at 9 A. M. on the 1st, full at midnight on the 7th, in her last quarter at 9 A. M. on the 15th, new at 11 A. M. on the 23rd, and returns to her first quarter at 2 P. M. on the 30th. She is nearest us on the 5th, and farthest away on the 17th.

While traveling around the skies, she passes near Uranus on the 11th, Jupiter on the 12th, Saturn on the 22nd, Mercury and Neptune on the 25th, Venus on the 26th, and Mars on the 27th.

At 2 A. M. on the 22nd, the Sun attains his greatest northern declination, 23 degrees 27 minutes 10 seconds, and enters the "sign" of Cancer, which, being an imaginary region of the ecliptic and affected by precession, has during the last 2,000 years backed into the constellation Gemini, and, as the almanacs will have it, "Summer commences."

Princeton University Observatory.

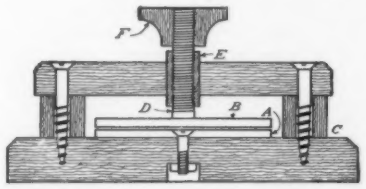
Guinea Pigs were imported into this country for laboratory experiments during the year ended June 30th, 1913, to the number of 12,112, as compared with only 1,471 the year before.

A Variable Condenser

By Frederick E. Ward

IN constructing his own wireless receiving apparatus, the average amateur probably encounters his greatest difficulty in making a good variable condenser, because the commercial form of this instrument, consisting of a system of fixed and of movable vanes, requires that a large number of parts be made and assembled with considerable care.

To overcome these difficulties the author has de-



Constructional details of the condenser.

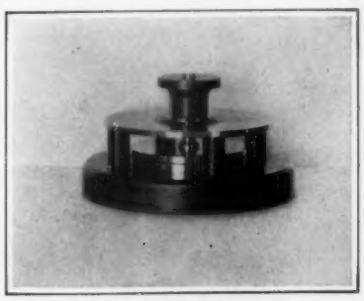
veloped the simple form of condenser shown in section in the accompanying drawing, where *A* and *B* represent the condenser plates, which are two brass disks about 3/32 inch thick and 2 inches in diameter. The first of these plates is fixed to the frame *C*, of wood or of other suitable insulating material, by a machine screw and nut which also serves as a binding post. The other plate is attached to the screw *D*, passing through the nut *E*, and carrying at its upper end the insulating knob *F*, by the turning of which the top plate is adjusted up or down, thus taking advantage of the law that, other things remaining constant, the capacity of a condenser is inversely proportional to the distance between its plates.

In making the simple form of variable condenser just described, it should be borne in mind that the best results are to be obtained by the use of a screw of fine pitch and of large diameter, such as is used in the well-known micrometer caliper. Not less than forty threads per inch, with a diameter of ¼ inch, is recommended. Care should be taken that the nut and screw are a reasonably good fit, and that the upper disk be turned off in the lathe so that its face will be truly at right angles to the axis of the screw. The lower disk should be leveled up by shims of tissue paper, if necessary, so that the two disks meet squarely when screwed together.

When the condenser is to be used in series with a large receiving aerial, for shortening its natural wavelength, it is of advantage to have nothing between the disks but air, for then they can, on occasion, be conveniently screwed together and short-circuited. If, however, the condenser is to be used in parallel with receiving instruments, where a short-circuit would be undesirable, this mishap may be guarded against by laying between the disks a slightly larger disk made from a film of clear, white mica one thousandth of an inch thick. This mica film has the effect of multiplying the maximum capacity of the condenser by a factor of about six.

In the photograph is shown a well-made instrument of the type just described. This one has a top piece of brass supported by four hard rubber posts, through which pass the four machine screws by means of which it is fastened to the base. The adjusting screw is provided with a graduated thimble so that the distance between the plates can be read off as with a micrometer, this serving as a scale. The knob could just as well have been provided with a hand or pointer moving over a scale marked on the top plate.

Such an instrument is suitable for use in a wavemeter of the Doenitz type, for which purpose it has a slight advantage over the usual form of condenser in that its capacity increases rapidly toward the end of the scale where the plates come together, while in



Home-made variable condenser.

the ordinary form the capacity varies uniformly along the scale. Since it is desirable to calibrate the scale directly in wave lengths, which are proportional to the square roots of the capacities, the disk type condenser, therefore, gives more nearly uniform scale divisions.

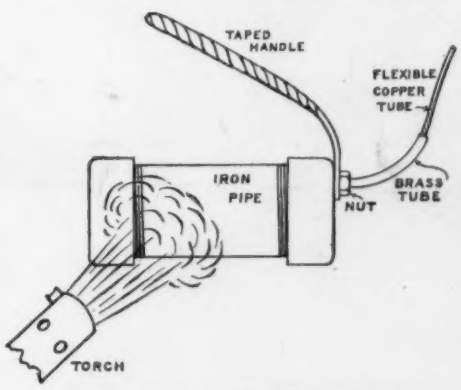
The maximum capacity of the average commercial type of variable condenser is about 0.003 microfarad. The calculated capacity of a pair of 2-inch circular plates spaced one thousandth of an inch apart in air is only about 0.0007 microfarad, but this value is increased to about 0.0045 microfarad by the introduction of a mica film, as recommended. In either case unscrewing the plates until they are 0.01 inch apart reduces the capacity to about 0.00007 microfarad. It will be seen from these figures that 2-inch disks are large enough to serve a useful purpose in many cases, though larger plates may often be employed to advantage.

Construction of an Oxygen Carbon Remover

AN oxygen generator for removing the accumulation of carbon from the combustion chamber and the piston of an internal combustion engine may be constructed as follows:

Take a short length of wrought iron pipe 1¼ inches in diameter, and thread and cap it at either end. Through one cap drill and tap a hole to receive a length of brass tubing. Solder a suitable length of annealed copper tubing into the end of the brass pipe. A handle may be provided by fitting in position a piece of ¼-inch strap iron, drilled for the passage of the brass tubing, and securing it with a nut as is shown by the sketch. The handle should be taped.

To use the device, a couple of ounces of chlorate of potash, to which has been added a teaspoonful of manganese dioxide, the two being thoroughly incorporated, are introduced into the chamber formed by the pipe, the rear cap being removed for the purpose. After the cap has been screwed tightly in place again, the chamber is heated with a blow torch and the end of the flexible copper tubing is introduced into the combustion chamber of the motor. As soon as the ingredients are sufficiently heated, oxygen is given off and the heat should be kept constant to insure a steady flow. In the presence of the oxygen, the caked car-



Oxygen generator for removing carbon from pistons and cylinder.

bon can easily be ignited and will burn from the surfaces in a minimum of time. Care should be taken not to apply too much heat. For cleaning multiple cylinder motors, the quantities of chemicals can be increased. Since the manganese dioxide acts merely to stimulate the decomposition of the potassium salt, it is evident that the proportions are not all important. Both chemicals can be obtained from any chemist in small quantities, and at low cost. Care should be exercised to keep foreign substances from contact with the chlorate of potash.

Dangers of Aviation.—In an interesting volume by Roger Depaginat on the martyrs of aviation, some interesting statistics are given showing the progress accomplished from 1908 to 1912. The total number of aviators for each year is given, together with the total distances traversed in the air. The price paid in lives for these triumphs is also given.

Year.	Aviators.	Miles Traversed.	Killed.
1908	5	1,500	1
1909	50	40,000	3
1910	500	920,000	29
1911	1,500	3,000,000	78
1912	5,800	17,000,000	140

Another table is attached showing the advance made per life lost.

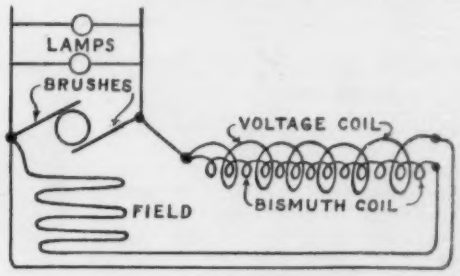
1908 one killed for 1,500 miles of flight.
1909 one killed for 14,000 miles of flight.
1910 one killed for 32,000 miles of flight.
1911 one killed for 40,000 miles of flight.
1912 one killed for 120,000 miles of flight.

Thus, from 1908 to 1912, the number of fatal accidents has proportionally diminished from 100 to 1, if one considers distances traversed, and from 10 to 1, if one considers the number of aviators flying. At this rate aviation will soon be less dangerous than automobiling.

Automatic Voltage Regulator

By J. Naveman

THE writer recently installed a shunt-wound dynamo on a motor car to supply current for lighting purposes, the drive of the motor being taken directly off the cooling fan pulley. However, the regulation



Automatic voltage regulator.

of the output at the varying speeds offered a serious problem.

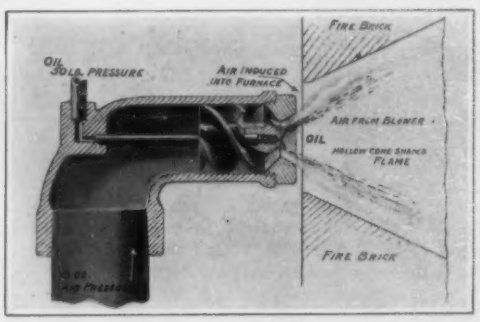
The resistance of bismuth increases when it is placed in a magnetic field, and the amount of increase varies directly as the strength of the field, within certain limits. Forearmed with this knowledge, the regulator shown by the accompanying sketch was constructed. A coil of bismuth wire was placed in series with the field of the dynamo, and the bismuth coil was made the core of a voltage coil which was connected across the lamp circuit. Under these conditions, the bismuth was subjected to the fluctuations of the voltage as indicated by the varying strength of the magnetic field of the voltage coil, and the resistance of the bismuth varied accordingly. When the voltage rose, due to increased speed, the field strength and resistance increased in proportion, cutting down the strength of the field circuit.

The chief difficulty lay in forming the bismuth coil, since that metal is too brittle to be drawn to a filament. It was solved by embedding a long, loosely coiled steel spring, previously oiled, in plaster of Paris, and, after the material had set, unscrewing the spring from the plaster. The bismuth, molten of course, was forced into this mold with the aid of a dentist's vacuum casting machine. When the plaster was carefully broken away, a perfect coil of the desired metal was left.

Low-pressure Atomizing Burner

OIL burners using high-pressure air or steam have been predominant ever since oil has been used as a fuel, owing to the difficulty of atomizing the oil with low-pressure. The typical low-pressure burner merely projects into the furnace a core of oil surrounded by a column of air, which on striking an abutment in the furnace causes an admixture of the oil and air.

The atomizer here illustrated embodies some radical improvements designed to convert the oil into a fog or mist. It comprises an inner nozzle through which the oil is delivered from under a high pressure. The passage-way in this nozzle is terminated, at the delivery end, by a small orifice, and within this passage there is placed a spiral. The oil is guided around this spiral, effecting a violently whirling jet in the orifice, which action causes it, upon delivery, to spread out in a cone-shaped film. Surrounding this nozzle is a casing, inclosing a large spiral, through which the air (or steam) must pass, so that the air, too, is delivered from the final restricted discharge orifice in a whirling current, which action likewise causes the air to assume the form of a hollow cone-shaped film. The oil film is drawn into the whirling current of air, and, being the heavier fluid, the centrifugal force throws it toward



Low-pressure atomizing burner.

the outer edge of the air film. The air from the blower therefore penetrates the mechanically atomized film of oil and reduces it to a fog. This action results from blower air of under 8 ounces pressure, giving a high degree of atomization at low cost and a mixture which affords perfect combustion without an excess of air.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Dumping Truck for Ash Removal

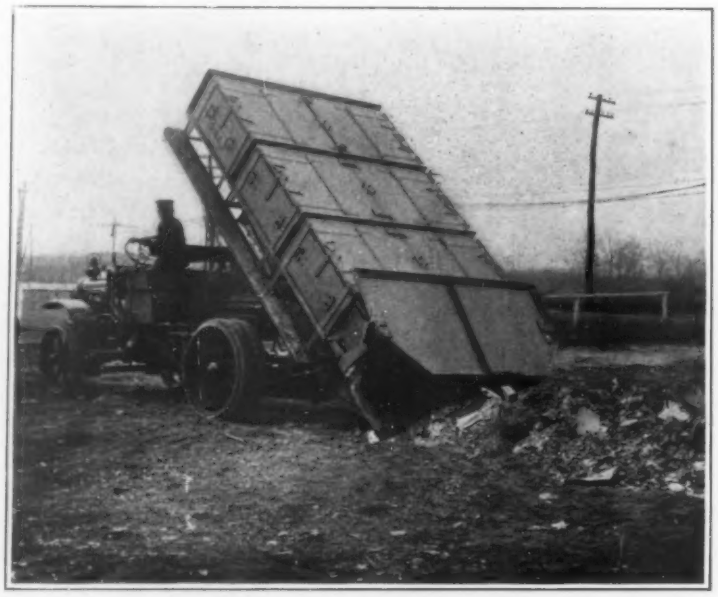
By Ross Babcock, M.E.

THE removal of accumulations of ashes and other refuse always has constituted more or less of a problem in large cities. Now, however, the municipal authorities of Greater New York would seem to have solved the problem in an effective manner. There just has been placed in service a new type of motor-propelled and dumped vehicle which takes the place of no less than 15 to 20 horse-drawn carts of the usual type. It is shown by the accompanying illustrations.

The new truck is not like anything else of its kind. It has an underslung frame, and the sides are so arranged that it never is necessary for those loading the vehicle to lift ash cans more than waist high. The truck will hold about 120 cans of ashes. The body itself, which is made of steel, is 13 feet 3 inches long and 7 feet 6 inches wide, the rated capacity being 252 cubic feet. Both the sides and the top are removable sections. The dumping mechanism is operated by the motor and in the hoisted position the body rests at an angle of 53 degrees. Thus, the load can be dumped at any prescribed spot, or may be slid directly into the scows used for such purposes.

The truck now has been in use for some time, making the haul to the dumping ground—a run of about three miles—in 14 minutes on the average. One man drives the truck and operates the dumping mechanism, and as it has a capacity equal to five of the ordinary horse-drawn carts, the saving in operating expenses is material.

The ash cans need be lifted only waist high.



The load can be dumped at any prescribed spot.

Unretouched photograph of road surface, showing disintegration of the top layer due to flow under traffic.

Road Structure and the Commercial Car

By K. G. Martin

COMMERCIAL car manufacturers should come to an appreciation of the very great need for concerted and definite action on their part in the matter of modern road construction.

Those who have to do with pleasure vehicles have from time to time evinced some interest in the matter and we have, of course, our good roads associations. There has been lacking, however, that knowledge and desire for knowledge among the builders and users of modern trackless freight carriers regarding road structure that constitutes so essential a forerunner to combined and effective effort.

Undoubtedly by far the greater field for the motor truck lies in our rural districts, and it is here that the greatest work is to be done in putting upon a scientific and commercial basis road building on a large scale, and just so energetically as the truck-makers fight for good roads just so quickly will come their returns from this almost virgin field. We hear much of service stations and the like, but is it not the part of really worthwhile service to be constructive in its nature, and to endeavor to improve and perfect the road surfaces over which the road vehicles are to travel? It would seem so, for notwithstanding all the care and effort put into the design and construction of a commercial motor car, the forcing of it over badly paved highways at commercially necessary speeds will bring about its disintegration in an alarmingly short time. It is not too much to say that the ratio of the weight of the empty truck to the weight of the load it will carry could be greatly reduced if it were known that it would not be required to so fashion the structural members—frame, ties, struts, axles, wheels, etc.—that they must be able to withstand without fracture or permanent distortion many times their ordinary working stresses.

Another and most important phase of the truck question, and one that affects the utility of this up-to-date beast of burden to a marked degree, is the matter of speed. It is not alone to its surefootedness, freedom from sunstroke, rapid acceleration and deceleration, that the vogue of the motor-wagon is due, but in a very great measure to the saving of time effected through comparatively higher speed. The higher the speed can be pushed the greater will be the saving. Why, therefore, is the speed of motor trucks held to-day within such low limits? We know that outside of "joy riding" and "scorching," and barring drunken and otherwise palpably unfit drivers, that increased speed in motor travel does not mean a proportionate increase in the number of accidents. But the speed of commercial cars is strictly limited in the majority of cases, either through gearing or through direct engine control, so that the driver cannot exceed a certain predetermined maximum rate. Evidently the speed limitation is set by the manufacturers, who have learned by their own experience, or by that of others, at what speed their vehicles can travel over the poorest road conditions to be encountered without a total collapse.

The methods of road work in the United States and in Europe are dissimilar in many respects, the point of differentiation most interesting to us being the feature of maintenance. Roads are built in this country—and rebuilt. They are constructed sometimes with exceeding care, and are then neglected until they have been so far disrupted and broken that they not only cease to serve as highways, but are even unfit to form the foundation of a new road surface, and have to be entirely rebuilt.

We can and do build good roads, but we do not take care of them. Maintenance, as understood and practised in France, for instance, is non-existent in this country. France has undoubtedly reached the high-water mark in roadways, and its main thoroughfares are a delight to behold and a joy to travel over, and there is absent that only too well-known feature of American touring—fifteen miles of perfect roadway, hard as nails, dustless, beautifully cambered, with just the proper heel at the curves—then, five miles of broken stone, soft fill, steam rollers, and fresh tar oil.

In cities, where the pavements are being constantly disturbed for the repair or extension of subsurface utility structures, and the original tenacity and combined resistance of the surface and foundation are impaired, both as regards their immediate relation, and the relation of that particular section to the surrounding and adjacent roadway, it is not surprising that sinks and pits develop. But in the suburban or country roads of either the plastic or pressed dirt type, it is often difficult to account for the holes that occur. As a rule, these can be traced to an original minute flaw or abrasion that, in the absence of the constant inspection and replacement that should prevail, develops under the pound and rack of traffic into an ever widening and deepening opening. Occasionally they can be traced to a cut or break caused by the solid rubber or steel-shod wheel of a heavy vehicle. This has led some people to suggest tne strict limiting of the weight of commercial motor cars that may be operated over such roads, but it would seem rather that the roads should be built to stand the traffic.

There is one element of road disturbance which should merit attention from the truck-maker, as it has developed since the motor truck has come so largely into use. It is the "flow" of road surfaces under the influence of heavy traffic, and reaches its most noticeable and destructive form in city streets where the traffic is unidirectional. If a grade exists, the effect is intensified. In the case of an asphaltic or plastic covering the surface is stretched and forced down the grade to some point where the resistance is sufficient to withstand the pressure exerted by the rolling-out action of the wheels, and at this point the surface is forced into ripples and billows that are soon cut in their turn into ruts and holes. In the case of rectangular creosoted wooden or asphalt composition blocks there can, of course, be no such rolling out of the blocks, so they move

(Concluded on page 452.)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Aeronautics.

PYROTECHNICAL ILLUMINATING DEVICE.—E. HYRA and K. KLINKOSCH, Vienna, Austria-Hungary. The invention provides a pyrotechnical luminous body which will be automatically ignited when dropped from an aircraft. The frame carrying the luminous body is capable of receiving a written communication and the luminous body will indicate the place where the manuscript rests when it reaches the ground.

Pertaining to Apparel.

HAT FASTENER.—G. A. ULRICH, City of Mexico, Mexico. An improved method of holding hats on the head is provided by this invention. The hat is furnished inside with combs which are pressed by a spring member into the hair, but which may be withdrawn from the hair, when it is desired to remove the hat, by means of pins secured to the combs but extending to the outside of the hat.

BLOOMER SKIRT.—M. LANGMAN, 47 Elton Street, New York, N. Y. This bloomer skirt is especially adapted for use when exercising, skating, swimming, riding or the like, and is arranged to permit free movement of the limbs. It consists of bloomers with integral overlapping front flaps and rear flaps which may be fastened together to provide a skirt effect.

HAIRPIN.—H. JACOBSEN, Address Ardon B. Judd, care of Capps, Cantey, Hanger & Short, Fort Worth, Texas. It has been found that the ordinary hairpin of the bifurcated type when not securely placed in the hair is very

HAIRPIN WITH HAIR-LOCKING MEMBER.

likely to jar or slip out and be lost. To obviate this, the present invention provides the hairpin with means for gripping the hair so that it will remain in place.

Electrical Devices.

FIRE ALARM CIRCUIT CLOSER.—B. TRENT, 50 Chester Avenue, Clifton, N. J. The invention provides in connection with a pair of conductors forming a part of a fire alarm system a third conducting member held inoperative by a fusible connection, so that in case of fire this connection would melt, releasing the conductor and permitting it to drop upon and make contact with the two line conductors, thereby sounding the alarm.

Of Interest to Farmers.

PLOW.—O. L. E. H. OLDENBURG, Mount Moriah, Natal, South Africa. This invention provides a plurality of plow shares and mold boards mounted on a shaft adapted to be rotated, the boards being curved in the manner of a screw propeller blade, so that they will cut the ground and turn it over thoroughly, one mold board extending beyond the vertical plane of the land side of an adjoining plow member to work more thoroughly the surface of the ground between the end plow members on the shaft.

Hardware and Tools.

WRENCH.—J. H. KUHNS, address Curry & Spillers, Tulsa, Okla. This improvement provides a wrench for use in any work, especially for turning pipes and other cylindrical objects, wherein the movable and fixed jaws are connected by a rack and gear wheel, and wherein a pawl is provided for locking the gear wheel from rotation to hold the jaws in fixed position.

NOZZLE.—H. BIRNBAUM, Rapid City, S. D. The object here is to provide a nozzle which will permit of the discharge of various sized streams therefrom, and which may be readily and quickly adjusted to vary the size of the stream, and a further object is to provide a nozzle with means whereby a spray may be discharged along with any of the streams of water when it is so desired.

Heating and Lighting.

OIL-BURNER.—W. T. DOWLING, Delia, Kansas. This oil burner is adapted to be used in stoves, and comprises a base having a pan at one side for oil to start the burner and a gooseneck leading from the open base and terminating in a bell over the pan. The air and fuel enter the burner in the top of the bell. After the burner has been started the flame burns around the mouth of the bell.

STOVEPIPE SHIELD.—E. GIER, Mount Angel, Ore. This shield serves to protect adjacent walls, buildings, trim, furniture, and other structures from injury by heat emanating from the stovepipe or other element with which the shield is employed, which can be readily mounted in position and as readily taken down, which comprises a plurality of interchangeable sections which may be of any desired number, and which requires no structural change in or addition to the stovepipe with which it is employed.

HOT AIR FURNACE BONNET.—W. P. DAW, care of the Wilbur S. Steele Co., Hartford, Conn. The bonnet is made of parts so designed that the bonnet can be shipped from manufacturers or jobbers in collapsed form to the point of installation, as the parts can be readily locked or fastened together without special machinery or particular skill to form the complete bonnet for application to the body of the furnace.

CONTROLLING DEVICE FOR WATER-HEATING SYSTEM.—J. E. GOODWIN, 50 Walnut Ave., Norwood, Mass. To eliminate expansion pipes in water-heating systems this invention provides a casing having two valve-controlled communicating openings, one being a relief valve and the other a pressure reducing valve. The device is easily accessible for inspection and causes a quicker circulation of water, therefore permitting a reduction in the size of the pipe.

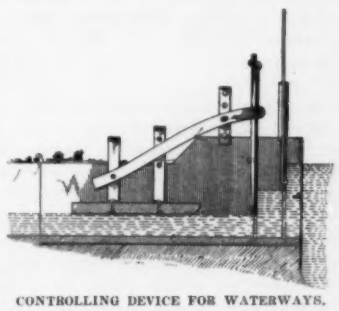
Of General Interest.

AIR TANK.—W. V. GARCEAU, Grand Rapids, Mich. This improvement relates to tanks and more particularly to compressed air tanks, the purpose of the invention being to provide a compressed air tank in which, under suit-

AIR TANK.

able conditions, the body portion of the tank expands and contracts according to air pressure carried—or in other words, according to the amount of air contained in the tank. The invention is of special service where lightness combined with small volume and freedom from mechanical complications is desirable.

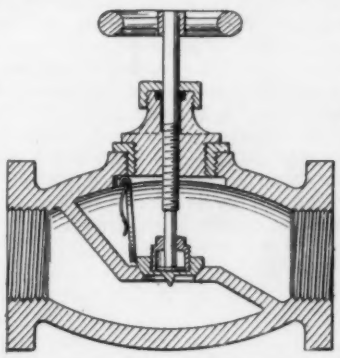
CONTROLLING DEVICE FOR WATERWAYS.—W. L. HURST, Box 572, Aspen, Colo. This inventor provides a device for use in irrigating ditches and other waterways, and



CONTROLLING DEVICE FOR WATERWAYS.

arranged to automatically regulate the volume of water flowing through the ditch under normal conditions, to keep the controlling device automatically free of accumulating trash and other extraneous matter, and to automatically close the waterway in case of a flood.

VALVE.—J. A. WILSON, 18 Abbott St., Detroit, Mich. The primary object of this invention is to provide a valve body having a valve opening on one side, said opening to be



STEAM FITTING OR WATER DISTRIBUTING VALVE.

closed by a special form of plug and bushing, the plug carrying the valve stem, and there being provided a pivoted check valve adapted to close automatically against the inner edge of the bushing when the valve is removed.

SALES DEVICE.—F. W. DEWITT, Box 366, San Francisco, Cal. In dry climates it is difficult to sell cigars from the top of counters because they dry out very quickly. Accordingly, Mr. DeWitt has invented a device consisting of a series of jars in which the cigars are held for display, and which may be individually uncovered, and tilted toward the customer by the operation of finger keys.

UMBRELLA-PROTECTOR.—H. C. ANDERSON and A. P. KEMMER, 2461 Frisby Avenue, Westchester, New York. The invention provides an insulating and cushioning protector for the tip of the umbrella rod to protect the person carrying the umbrella from the effect of shocks from electricity and to prevent injury to the joints and catches of the umbrella when it is used as a cane.

CASTING OF IRON.—I. E. LESTER, 44 Sandwell road, Handsworth, Birmingham, England. The object of this invention is to provide simple and reliable means for imparting a hard surface to an iron casting for the resistance of wear, while retaining that toughness in the body of the casting which is necessary for the resistance of stresses liable to cause fracture or breakage.

HALTER.—R. SCOTT, care of Harvey B. Dick, 329 Second Ave., East Kalispell, Mont. Mr. Scott's invention relates to halters, and it has for its object the provision of one having two parts of tubular steel which telescope, and which are normally positioned on th horse below his eyes, straps being provided for holding the tubular steel parts in place.

Machines and Mechanical Devices.

FIRE FIGHTING APPARATUS.—S. B. WILLIS, 582 Broome St., New York, N. Y. This invention provides a mechanism to support a fire hose at an elevation for fighting fires, the nozzle being manipulated to play the water on the fire in simulation of manual manipulation; and provides a supporting mechanism upon an extension ladder with nozzle manipulating means operable from the foot of the ladder.

PROCESS OF STERILIZING AND PACKAGING RICE.—W. S. DAVIS, JR. Address Seaboard Rice Milling Co., Galveston, Tex. The shaker, the bin, the packaging machine, and the cartons are covered and protected, preferably by sheet metal hood or hoods, so that fresh or cool air is prevented from access to the heated rice from the point of its discharge from the drier to its delivery and sealing in the package, whereby the cracking and breaking are effectually avoided.

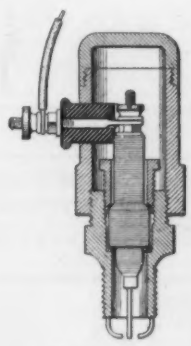
LIQUID MEASURING DEVICE.—E. A. APPELL, 793 E. 168th St., Bronx, N. Y. The object here is to provide a liquid measuring device for measuring liquids periodically drawn from a barrel or other container. As the amount of air passing into the container by the way of the liquid measuring device is the same as the amount of liquid withdrawn, it follows that the amount registered by the registering end indicates the amount of liquid withdrawn from the container.

CLEANING AND SCOURING ATTACHMENT FOR METAL ROLLS.—J. DUNLOP and J. D. DAVIDSON. Address the former, 909 Center St., Wellsville, Ohio. This invention is particularly intended for cleaning and scouring the surface of metal rolls used for rolling steel plates or sheets. The apparatus used is automatic and produces a roll face which is smooth and uniform, steel sheets being rolled flat, without stopping the normal operation of the mill, so that an important economy and perfect mechanical result are effected.

ROPE CLAMPS.—S. E. RYDER, 817 N. J St., Muskogee, Okla. The improvement is on that type of rope clamps whose chief parts are a frame, jaws or clamps proper hinged thereon, and a screw relatively connecting the outer ends of the clamp arms which project laterally from the jaws, so that by rotation of the said screw, the jaws may be clamped upon the rope with any required degree of pressure.

Prime Movers and Their Accessories.

SPARK PLUG.—J. DEL. BARMORE, Box 316 St. Vincent Island, Apalachicola, Fla. A contact member is provided which is surrounded except at the ends with an insulating material, and is clamped or connected with a sup-



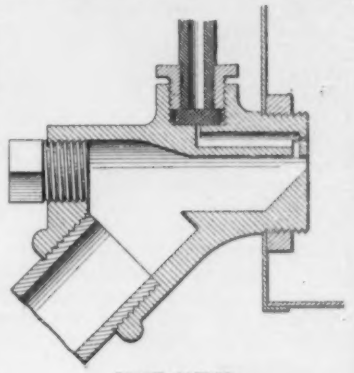
SPARK PLUG.

porting screw member which is designed to be secured into the cylinder of an engine, and to which is secured by suitable threads a protecting housing. A water-tight insulating member is provided for carrying the wire into the contact member so that a plug can be used at any desired place even though the same is submerged in water.

ROTARY VALVE.—C. H. BANTLEY, Lebanon, Mo. Use is here made of a rotary admission valve and a rotary exhaust valve, each valve consisting of two revoluble valve cylinders, one within the other and rotating in opposite directions, the valve cylinders having ports adapted to register with each other, and at the same time with a corresponding cylinder admission or exhaust port.

Railways and Their Accessories.

TRACK SANDER.—J. H. WATTERS, Augusta, Ga. Mr. Watters' invention has for its purpose to provide a track sander, simple in construction, the sander having an air jet which is disposed to discharge the air against an inclined

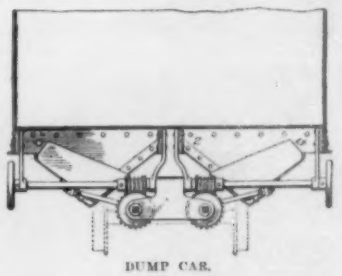


TRACK SANDER.

bottom member serving to direct the air together with the sand to an outlet disposed below the inclined bottom member. As there is practically no blasting against the sander casting proper there is little, if any, cutting action.

STATION-INDICATOR.—G. S. EMERY, 713 South 20th St., Birmingham, Ala. This station-indicator is adapted particularly for use on street cars to indicate to the passengers within the cars the various streets as they are reached. The indicator is actuated by plugs located on the tracks which engage a tripping member connected by suitable gearing to the indicator.

DUMP CAR.—J. D. METTLER, Snydertown, Pa. This inventor provides a car having hinged bottom portions which may be easily moved



DUMP CAR.

to effect the dumping of the contents of the car, especially coal, and which may be readily secured to hold the load without any danger of dumping the same in transit. He provides a device having means for draining water from the load, and at the same time preventing leakage of portions of the material which is being transported.

Pertaining to Vehicles.

TIRE.—R. E. STURMAN, Delano, Minn. The purpose in this case is to produce a tire which will have all the advantages in the way of resilience that are obtained by the use of pneumatic rubber tires, and which will in addition be more expansive than tires of the pneumatic type referred to.

Designs.

DESIGN FOR A LOVING CUP OR SIMILAR RECEPTACLE.—W. H. HEAD, Hooksett, N. H. The cup comprises a standard and a bowl shaped like an inverted cone. The bowl is provided with three handles, and there are six spoon-shaped ornaments symmetrically disposed about the cup with the bowls of the spoons clustered about the upper part of the standard.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Road Structure and the Commercial Car

(Concluded from page 450.)

in a solid mass, curving out from the curb at each side, those nearest the curb being held by the greater friction in almost their original position, those at the center being the keystones of an arch that has its apex pointing in the direction in which the traffic is traveling. Seams are thus opened up at the beginning of the stretch of roadway affected, causing bad bumps to heavy vehicles passing over them, and at the end of the stretch, blocks are often forced completely out of place. This curious glacial movement should, as has been said, have particular interest for the truck maker and user, since it is directly due to heavy motor traffic, and reacts directly upon that traffic in a deleterious manner. The matter of foundations for road structures should receive the most careful attention from those interested in the welfare of the commercial motor vehicle, for while the surfacing is most in evidence, and while it does the actual carrying of the load and must be depended upon for taking the brunt of the work, it can only do its share and no more.

Let us consider for a moment railroad work. Here the quality, weight and strength, as well as a number of subordinate but co-ordinate factors, of the steel rails, ballast, spikes, ties, plates—all that go to make up the railroad roadway, are known. The various parts are selected for their individual and collective efficiency, and these efficiencies, governing the safety, speed, and tonnage of trains and engines, are known, not only to the line's operating department, but to the builders of the coaches, gondola cars, Pullman diners, locomtives—in fact, to all those who manufacture rolling stock of any nature for the railroad's equipment. It may be said, and quite truly, that the railroad company not only runs the trains, but is also responsible for the roadbed; that is one reason why the railroads are able to provide the wonderful service that they do. Does it not seem as though it were up to the motor-truck manufacturers to take a hand in the building and maintenance of the roads and streets—the "rails" over which their "rolling stock" has to travel and demonstrate its worth to the commercial world?

Motor Truck Notes and Queries

L. L. S. writes: "There is an annoying squeak that seems to come from the springs of my one-ton truck. The machine has recently been overhauled, but it may be that the springs were not properly lubricated. What oil should be used, and how should it be applied?"

A. The frame of the car should be jacked up so that the axle is suspended from the springs. This will tend to separate the leaves of the springs somewhat, and then a mixture of thick oil and graphite or a graphite grease may be introduced between the adjoining surfaces of the leaves by means of a thin-bladed knife. Special devices are on the market, by means of which the leaves may be separated by tightening a nut that serves to introduce a wedge-shaped point between adjoining leaves. Although a portion of the truck that is too often neglected, yet it is the springs that are subjected to almost continuous work when the machine is in motion.

T. P. P. writes: "I have 4½-inch pneumatic tires on my delivery car, and desire to keep them pumped up to the pressure recommended by the manufacturers. What are the so-called 'spark plug tire pumps,' and are they injurious to the tire?"

A. The pumps to which you refer consist of a double cylinder, one end of which is designed to be screwed into the spark plug opening of one of the cylinders. When the engine is run on the remaining cylinders, the compression in the "dead" cylinder operates the plunger of the cylindrical pump, and *fresh* air is pumped into any tire with which the long tube extending from the pump may be connected.

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Inquiry No. 9359. Wanted the name and address of a firm that makes razor blades for all makes of safety razors.

Inquiry No. 9360. Wanted the name and address of parties making pipe fittings such as ferrules, stems and bowls such as could be used in the making up of calabash pipes for smoking.

Inquiry No. 9361. Wanted to buy a Nut Cracking Machine, especially good for Pecans.

Inquiry No. 9362. Wanted the name and address of the makers of a machine for splicing ties.

Inquiry No. 9363. Wanted the names and addresses of manufacturers of machinery for printing on intaglio copper plates.

Inquiry No. 9364. Wanted the name and address of buyer of mica in a crude state.

Inquiry No. 9365. Wanted the name and address of a manufacturer of machinery for embossing tin foil as is used in packing cigarettes.

Inquiry No. 9366. Wanted the name and address of a manufacturer of wire wheels, front axles complete with steering or separate, light sheet metal bodies, fuel tanks with cocks, pressed steel frames, mufflers, motors of the two-cylinder opposed type, cushions and many smaller parts for cycle cars.

Inquiry No. 9367. Wanted the name and address of a manufacturer of an automatic centering machine.

Inquiry No. 9368. Wanted, the name and address of glass-bottle manufacturers or glass blowers who can manufacture a glass bottle and perforate it with some 12 small holes, in large quantities for export, to sell at a popular price.

Inquiry No. 9369. Wanted, the names and addresses of users of Indian Steatite (Soapstone), Corundum and other Indian minerals, in quantities.

Inquiry No. 9370. Wanted the names and addresses of manufacturers of small wooden articles, particularly in such soft woods as pine and fir, for articles such as toys, furniture, etc.

Inquiry No. 9371. Information wanted where one could buy or have made to order machine to be used for making solid back brushes.

Inquiry No. 9372. Wanted the name and address of manufacturers of a collapsible box about 12 inches square. It must be strongly made to withstand rough usage in transit.

Inquiry No. 9373. Wanted the name and address of a manufacturer of machinery that will make twine out of scrap paper.

Inquiry No. 9374. Wanted the name and address of manufacturers of a powder paste which, when mixed with cold water, will make a white paste suitable for papering, costing no more than 3 cents per pound in ton lots.

Inquiry No. 9375. Wanted the name and address of the manufacturer of a separable fastener, invented especially for shoes and other articles.

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If a gage is used to determine the correct pressure, you will find that these pumps give excellent results at a great saving in time and labor. Inasmuch as the pure outside air is pumped, the objection that the uninformed hold against them—to the effect that the gasoline in the mixture as it comes from the cylinder and is pumped into the tires, tends to rot the fabric—is seen not to be valid.

Basket Willow Culture in the United States

(*Concluded from page 439.*)

according to the soil. In moderately moist, porous soil they should be from 8 to 10 inches, but where the water level is below 6 feet they should be 12 inches long. To plant them too close together or too far apart reduces the commercial value of the crop. From 9 to 12 inches apart in the row and 2½ feet between the rows is the usual spacing followed. If planted far apart they produce thick tapering rods, which are less valuable.

Harvesting the rods begins about the middle of January, and this work must be completed before the sap commences to rise. The young shoots are cut with a short hooked knife as close to the stump as possible. The rods are next tied into bundles and placed in a pit of running water from 4 to 6 inches deep. They are left in the pit until the sap rises, when the bark is easily removed. This is known as sap peeling. Another method, known as steam peeling, consists in steaming or boiling the rods until the bark loosens, when it may be removed by hand. The apparatus for peeling consists of a round steel rod from ½ to ⅝ of an inch in diameter and about 4 feet long, which is doubled over so that the two ends are brought together, making a double rod 2 feet long. The lower or welded end of the parallel rods must be inserted vertically in a log placed at a convenient height. The operator places the thick end of the rod between the prongs and draws it toward him, and the bark is separated from the wood. The small end is then treated in a similar way, which completes the operation. The next operation is grading the rods into proper height and quality classes, after which they are bundled up and prepared for market. The market price for green unpeeled rods, cut and delivered at the railroad, ranges from $10 to $30 per ton. From 4 to 8, or sometimes 10 tons, may be grown on an acre. The crop from an average acre should bring $150, of which one half should be net profit.

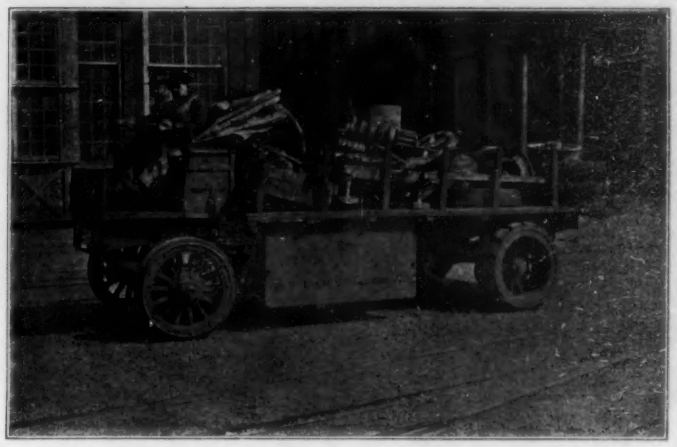
In Pennsylvania and Maryland the willow growers prefer to cultivate the American green willow, which produces longer and stouter rods. The methods of culture and of handling the product after harvesting are practically the same as in New York, and it will be unnecessary to enter into details, but simply note one or two points in what may be called the Pennsylvania-German system. Here cuttings are planted in rows of from 18 to 24 inches apart and from 8 to 10 inches apart in the rows. This method of spacing renders the stand very dense. In this region willows are considered wet-soil demanding plants, and nearly all plantations occur along streams. In New York the best land on the farm is appropriated for growing willows, because this crop in rich soil and under intensive management yields a return equal to or greater than most other farm crops. While these plantations produce rods of the highest quality, it must be admitted that many plantations in Pennsylvania and Maryland produce a quality of rods that cannot be surpassed in any part of the country or even abroad, where willow culture has been practiced for over 800 years.

The Principle of the Bicycle Applied to the Motor Car

(*Concluded from page 442.*)

the car is on an even keel the rack *R* and the pinion *U* are not in engagement, but a very small upward movement of the rack is sufficient to establish such engagement.

It will thus be seen that if the car swings over to the right the left-hand rack *R* and pinion *U* are brought into mesh. If the swing



Heavy Duty G. V. Electric Trucks

This is one of the G. V. Electric trucks used by the Bethlehem Steel Company. The daily mileage is small but the truck solves the problem of yard transfers at minimum cost.

One of the several 5-ton trucks used by the National Sugar Refining Company made 10,989 miles in 300.5 working days in 1913. This was an average of 33.24 miles per day, while the rated mileage of the truck per battery charge is but 35 miles. This mileage was made, too, on short runs from refinery to railroad and warehouse.

A 5-ton G. V. Truck in Wisconsin moves both flour and grain in one non-dumping body, the wheels being clamped to a platform which tips sufficiently to discharge the grain. The round trip is but 1,700 feet and the truck is charged but twice each week. Yet it displaces 6 horses and 3 men.

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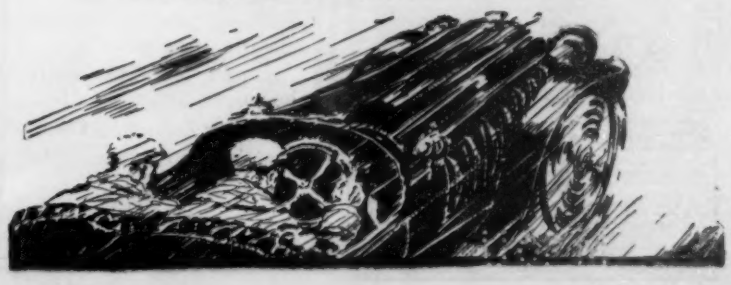

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is to the left the right-hand rack and pinion are engaged.

We now come to the gyroscope and its details. The gyroscope wheel *A* (Fig. 3) is mounted inside a cage consisting of top and bottom plates *B B*, four corner pillars, and two cross-bars *C*. These cross bars are provided with pivots *D*, which pivots are carried in bearings on the pillar *P* (Fig. 2) directly behind the pin joint *Q*. Returning to Fig. 3, it will be noticed that the plane of rotation of the gyro-wheel is above the line through the pivots *D*. In this respect Mr. Schilowsky claims that his system is different from the gyroscopic monorail carriages of other inventors. The difference seems little enough, but it has a very marked effect on the behavior of the device. It would, however, lead us, were we to discuss this point fully, into a long and tedious mathematical analysis of gyroscopic phenomena in general. Suffice it to say, then, that the gyroscope spindle *E* is directly connected to an electric motor carried on the lower plate *B* (Fig. 3) and indicated by the dotted lines *F*. The speed of rotation of the gyro-wheel is 3,000 to 4,000 revolutions per minute.

The upper end of the gyro-spindle carries a worm *G* which meshes with a worm wheel *H* carried on a shaft *J*. This shaft is journaled in bearings on the top plate *B* and is disposed crosswise of the car—that is to say, at right angles to the track. At one end the shaft *J* carries a gear *K*, which, meshing with a second gear *L*, transmits motion to a second and parallel shaft *M*. At the other ends of the shafts *J* and *M* are pinions *U*, which pinions are those similarly referred to in Fig. 2. It is clear that if the gyro-wheel is rotating anti-clockwise when viewed from above, the direction of rotation of the gears will be as shown by the arrows. Viewed as drawn in Fig. 3, the left-hand wheel *U* has a clockwise rotation and the right-hand one an anti-clockwise.

Imagine, once again, that the car is lurching over to the right. As all acquainted even but slightly with the properties of the gyroscope are aware, such a movement as this—or, to be quite exact, the application of the torque implied by this movement—will cause the gyroscope to precess round an axis at right angles to the axis about which the movement is taking place. This last axis is, of course, the line of motion of the car, and the axis about which precession is set up is that of the pivots *D* (Fig. 3). With a right-hand lurch the upper end of the gyro-spindle *E* goes forward, so that the pinion *U* on the left-hand side moves into some such position as *W* (Fig. 2).

So long as a lurching over to the right continues so long will the gyroscope, if left to itself, continue to precess. But it is not left to itself. As we have said above, a right-hand lurch causes the left-hand rack *R* (Fig. 2) to rise, and the lurch has not proceeded very far before the rack and the rotating pinion *U* come into mesh. As soon as this occurs the precession is checked, for the pinion *U*, rotating in the direction of the arrow *X*, obviously will pull the rack round on its pivot *Q* in the direction of the arrow *Y*. Under these circumstances, then, the precession is checked by the force of the spring *Z*.

Now, when the gyroscope is mounted as is this one, and when its precession is checked, it develops a torque about an axis—the line of motion of the car—at right angles to the axis of precession. Why it should do so cannot be explained without a considerable amount of analysis. But we may say that the same fundamental principle is at work here as in the case of an ordinary spinning top. It is a matter of common observation that if we hasten the precession of a top it will lift its axis more nearly vertical. If we check or retard the precession the axis tends to fall.

In the case of the gyroscope in the Schilowsky bicycle automobile the torque developed by the checking of the precession opposes the lurching, so that the overturning couple is overcome. The restoring couple developed by the gyroscope continues in action until the car has so far righted itself that the rack is lowered by the pendulum out of engagement with the pinion *U*. In actual running it requires very close watching to discover that the gyroscope is continually precessing in one direction or the other. But it can be seen and at the same time it will be noticed that the racks *R* are continually rising, checking the precession, and falling again.

The inventor claims that a mono-track motor car, running under gyroscopic control, may attain a given speed and efficiency with a much less powerful engine and with a lighter frame and body-work than would be required for a four-wheeled car of the same rating. He also points out that a mono-track car requires only the narrowest of paths, hence its special applicability for use in new and undeveloped countries. Further advantages are said to be a gain in smoothness of running, a lessened fuel consumption and cost of production, and a gain in safety when running at high speed on horizontal curves.

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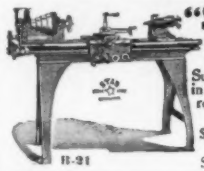

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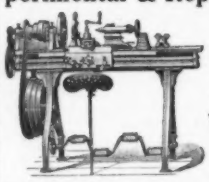

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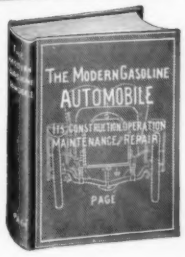

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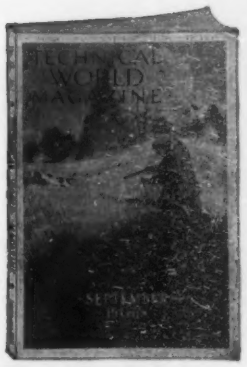

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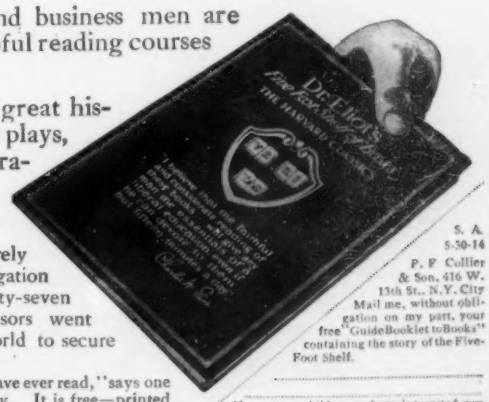

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